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DAVALLODES AND RELATED GENERA

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FIVE PLATES

A tribe or family of ferns having *Davallia* as its typical genus has been recognized by practically all students of ferns for a full century. A tribe of "Davallieae" was first so called by Gaudichaud in 1826, albeit as a group subordinate to Hymenophyllaceæ. As a name is needed for the group of genera to be treated here, and this one is established in literature, I retain it, but in a much more restricted sense than has been usual.

The ferns here in question—to locate them most conveniently—are, in Christensen's Index: *Humata; Davallia,* but excluding *Prosaptia;* and section *Davallodes,* of *Microlepia.*

It is an Old World group, ranging from the Canaries eastward across Polynesia, but without a known representative in America. It is a group of epiphytes, with the stipe functionally or vestigially jointed. So far as I know any of them to be terrestrial, I regard them, as I do *Polypodium vulgare,* as having descended to the ground.

The affinities of the Davallieæ, sensu strictiore, will be discussed in connection with *Davallodes.* In advance, it may be said that they have affinity with *Oleandra,* but none equally close with any of the various other genera which have hitherto been incorporated into their tribe. Of the genera thus associated by Diels and Christensen, *Arthropteris* is more probably related to *Nephrolepis. Nephrolepis* is kin of *Cystodium,* going back to the Dicksonieæ independently of *Dennstaedtia. Saccoloma* is likewise at the nearest a cousin of the Dennstaedtieæ.

Dennstaedtia, Microlepia, and *Leptolepia* are nearly related among themselves, and close to the ancestry of *Tapeinidium,* of *Schizoloma* and its relatives (*Syngramma, Taenitis,* et al.), and probably of *Lindsaya, Odontosoria,* and *Diellia. Monachosorum* is more probably cyatheoid in origin, and *Dictyoxyphium,* whatever its affinity, seems far from any of these.

The genera to be recognized here, with definitions restricted to their essential characters, follow.

GENERA OF DAVALLIEÆ

Araiostegia.—Fronds thin, glabrous, several times pinnate with narrow ultimate segments; rhizome scales broad, not black, nor conspicuously ciliate, nor aciculate; sori small or of moderate size; indusium thin, free except at the base.

Davallodes.—Fronds thin, pubescent, several times pinnate with narrow ultimate segments, not deltoid. Rhizome scales aciculate above the peltate base, mostly black, not (or hardly) ciliate; sori small; indusium thin, variously affixed.

Trogostolon.—Fronds firm but hardly coriaceous, glabrous, several times pinnate with narrow ultimate segments, deltoid; rhizome scales aciculate above the peltate base, black ciliate; sorus of moderate size; indusium firm but not coriaceous, the upper part free.

Leucostegia.—Fronds herbaceous, pale green, glabrous, several times pinnate but ultimate segments not narrow; paleæ of rhizome broad, not black nor ciliate; sori very large; indusium fixed by base or base and sides, thin. Terrestrial ferns.

Humata.—Frond coriaceous, usually deltoid, glabrous or somewhat scaly; rhizome scales not aciculate, nor black, not ciliate or but slightly so; sori of moderate size; indusium firm to coriaceous, the sides free.

Davallia.—Frond coriaceous, glabrous, several times pinnate; rhizome scales ciliate, not black and hardly aciculate; indusium fixed by base and sides.

Scyphularia.—Frond coriaceous, glabrous, simply pinnate with broad pinnæ; rhizome scales black, aciculate, not conspicuously ciliate; indusium fixed by base and sides.

Genus **ARAIOSTEGIA** Copeland, novum

PLATES 1 AND 2

Filix Davalliae affinis, rhizomate repente paleis haud aciculatis ferrugineis, castaneis vel similiter coloratis non nigris, latis, non ciliatis vestito, articulatione stipitis dubia; fronde lan-

ceolata, ovata vel enim triangulare sed pinnis infimis sequentibus similibus, glabra, haud coriacea, aut tripinnatifida aut enim quinquepinnatifida, segmentis ultimis angustis; soris parvis, indusio tenue, basi affixo, sursum libero. Nomen ad indusium tenue refert.

ARAIOSTEGIA HYMENOPHYLLOIDES Copel., comb. nov., type species.

Aspidium hymenophylloides BLUME, Enum. (1828) 172.

Other species referable to this genus are:

ARAIOSTEGIA ATHAMANTICA (Christ) Copel.

Davallia athamantica CHRIST, Bot. Soc. Fr. Mém. 1 (1895) 65. Yunnan.

ARAIOSTEGIA CLARKEI (Baker) Copel.

Davallia Clarkei BAKER, Syn. Fil. (1874) 91. Himalaya, Yunnan.

ARAIOSTEGIA MULTIDENTATA (Wall.) Copel.

Aspidium multidentatum WALL., nomen nudum.
Davallia multidentata HOOKER, Syn. Fil. (1867) 91. Himalaya.

ARAIOSTEGIA PARVIPINNULA (Hayata) Copel.

Davallia parvipinnula HAYATA, Mater. Fl. Form. (1911) 431.
Leucostegia parvipinnula HAYATA, Icones Form. 4 (1914) 205, fig. 139. (See discussion, ibid.) Formosa.

ARAIOSTEGIA PSEUDO-CYSTOPTERIS (Kze.) Copel.

Davallia Pseudo-cystopteris KZE., Bot. Zeit. (1850) 68. Himalaya.

ARAIOSTEGIA PULCHERRIMA (Baker) Copel.

Davallia pulcherrima BAKER, Kew Bull. (1895) 53. Yunnan.

ARAIOSTEGIA PULCHRA (Don) Copel.

Davallia pulchra DON, Prod. Fl. Nepal. (1825) 11. Himalaya to Ceylon and China.

ARAIOSTEGIA YUNNANENSIS (Christ) Copel.

Davallia yunnanensis CHRIST, Bull. Boiss. 6 (1898) 970. Yunnan.

Other possible members of this genus are:

Acrophorus assamicus Bedd.
Davallia Beddomei Hope.
Davallia perdurans Christ.
Davallia rigidula Baker=*Yunnanensis.*
Leucostegia yaklaensis Bedd.

There have also been referred to *Leucostegia,* as a subgenus, several ferns from New Guinea and still farther east, with descriptions which would better fit *Araiostegia.* It is a priori quite improbable that a genus at home in Yunnan and the Himalayas, and unknown in Malaya and the Philippines except for a single species, recurs in diversity farther away. In the absence of the rhizome, a *Leptolepia* might easily be placed here;

Balantium dubium has been so misplaced; and the descriptions of two New Caledonia species permit even *Dryopteris* to be suspected.

If *A. hymenophylloides* be left out of account for the moment, the remaining genus is restricted to a very narrow range, only *A. pulchra* ranging south to Ceylon, and *A. parvipinnula* to Formosa.

Genus DAVALLODES Copeland

The original formal diagnosis of this group as a genus [1] is merely: "Genus Davalliearum, stipitibus articulatis, rhizomate pilis vestito." As this is neither accurate nor adequate, it is here replaced with one more sufficient to define the group as now understood:

Rhizomate repente vel scandente, valido, systemate vasculare reticulato, paleis basibus peltatis deinde aciculate protractis vestito; frondibus seriatis, haud deltoideis, tenuibus, axibus et saepe lamina pallide pubescentibus, pinnatis, pinnis ad alam rhachillae pinnatifidis, pseudopinnulis aut pinnate incisis seu eodem more magis dissectis; soris ad laminam dorsalibus, ad venam terminalibus saepius ad ramum venae abortivum ita ut laterales videntur, indusiatis, indusiis quoad formam variis, semper tenuibus.

The brief original diagnosis provided distinctions from *Davallia* and *Microlepia,* but did not properly exclude *Scyphularia,* nor several species which a somewhat more careful discrimination has placed in *Leucostegia,* and for which the genera *Araiostegia* and *Trogostolon* are here provided. As here defined, *Davallodes* is a quite natural genus. As genera go, it is remarkably uniform in gross characters—frond form, dissection, texture, paleæ—which commonly serve for the identification of species, and no less remarkably varied in the character, more often valid for the recognition of groups of genera, of the indusium.

This indusium may be ovate, and fixed by the middle of the base; it may be reniform, and fixed by more or less of its base; it may be much wider than long, and fixed by the whole base, and such an indusium may be shortened until it is sharply evident; or the sides may be attached, making it cup- or funnel-shaped; or it may be very long and narrowly cylindrical. Accustomed as we are to the identification of genera by the

[1] Philip. Journ. Sci. § C 3 (1908) 33.

form and attachment of the indusium, an obviously natural group with various indusia makes a strong appeal for recognition as the parent group of the clearly related genera with indusia of definite type.

If this suggestion be tested, it will be found possible to trace connections with some of the other genera, with considerable plausibility. Taking the characteristics of *Davallodes* one at a time, the transition to *Davallia,* for example, may be made to appear a gradual one. In sorus and form of indusium, several species of *Davallodes* are like *Davalliae—Davallodes dolichosorum* like *Davallia solida,* for example. In form of frond, *Davallia wagneriana,* with basal pinnæ similar to the others, is not very different from *Davallodes borneense.* They have in common the winged rachillæ of the pinnæ, and this *Davallia* is not without the tinge of red, which is conspicuous in this *Davallodes,* and *D. borneense* is notable in its own genus for nakedness and firmness of texture; but their indusia and the paleæ of their rhizomes are utterly unlike.

Of the species here treated as *Davallodes,* the other most divergent one is *D. membranulosa.* It is the smallest of the genus, and therewith its rachis is winged almost throughout. In texture, pubescence, general features of dissection, and a measure of inconstancy of indusium, it is absolutely a *Davallodes.* Its paleæ, however, are less abruptly narrowed, the needlelike point is short and less rigid, and in the mass they are ferruginous instead of black or red-black. The transition from *Davallodes* to *Araiostegia* exemplified by this species is very probably evidence of intimate affinity. With more plausibility than confidence, such connections can be traced between *Davallodes* and *Araiostegia* and the several other genera.

However, in the present state of our knowledge, the soundest opinion seems to me to be that no one of the genera of the Davallieæ is to be regarded as the parent of the others; but that, rather, they have a common descent from a more generalized ancestor which, if it exists, has not been recognized as such. To use the familiar figure of the phylogenetic tree, they are coördinate branches, not a series. In some respects, *Araiostegia* looks like the least specialized of them; but, so far as I am transferring species to it, it has the compact geographical range of a recent group, not nearly old enough to be or to exemplify the parent of *Davallia,* or *Davallodes,* or even of *Leucostegia.*

Davallodes has indusia more diverse in form than those of any other genus of ferns; but it is in this sole respect that it appeals for recognition as primitive. Its remarkable uniformity in other respects is evidence of high specialization, not yet interpreted in detail. The aciculate paleæ look like highly specialized structures, such as, once evolved, would not be likely to be lost. Taking this view, and granting that the connection between *Davallodes* and *Araiostegia* is a close one, the direction of descent would seem to be from *Araiostegia* to *Davallodes,* rather than the reverse.

However, one does not safely draw a conclusion from one side of the evidence. Also, it is very difficult to fix on a genus as primitive in its group, while a more remote source of the group as a whole is uncertain. I have in the past assumed, as have many or all others interested in this field in recent years, that *Davallia* and *Microlepia* were intimately related. *Microlepia* is positively primitive, as compared with *Davallia.* It is so positively more primitive that, if there were any near affinity between it and the Davallieæ as here limited, the most primitive of the latter should be identifiable by their resemblance to it. In the good old days of the supremacy of the indusium, this would have been easy. *Davallodes hirsutum* has the indusium of *Microlepia,* in form, attachment, texture, and pubescence; but it has a dictyostele, and is an epiphyte (these two features perhaps correlated), and it has peltate scales instead of hairs with unicellular base. To my great surprise, I have been unable to find any probable connection between *Microlepia* and any one of the genera here under consideration.

Outside of the Davallieæ, such scales are found in a very few other ferns. *Christiopteris Sagitta* has them. So have *Polypodium* (*Phymatodes*) *glauco-pruinatum* and *P.* (*P.*) *albido-squamatum;* and those of *Goniophlebium* are not very different. All of these are placed, with a large measure of probability, in the general alliance of matoniid ferns, among which indusia of any kind are unknown.

Such paleæ are borne also by *Oleandra*—more specifically by certain (or uncertain) *Oleandra* species of the Malay region. Other species of *Oleandra* have paleæ quite exactly like those of certain species of *Davallia,* in form, color, and texture, and in the peculiarly ciliate margins. In stelar structure, and in the articulation of the stipe, *Oleandra* and the Davallieæ are alike. In form and attachment of the indusium, most species of *Oleandra*

are like *Humata, Leucostegia immersa,* and some species of *Davallodes.* In leaf texture, *Oleandra* has not much more generic character than *Davallodes* has in form of indusium, wherein it is a worthy relative of a group including *Davallia* and *Davallodes.* The fronds of some of its species are pubescent, with hairs quite like those of *D. hirsutum;* others are glabrous, with the color and luster of *Scyphularia.* Altogether, I consider the affinity of *Oleandra* and the Davallieæ sure beyond a reasonable doubt, and believe that it is in *Oleandra*—not, either directly or indirectly, in *Microlepia* and *Dennstaedtia*—that the ancestral line of the Davallieæ is traceable. *Oleandra* is itself a very remarkable genus, to which I hope to return for a thorough study at another time.

As a matter of convenience, since the species have not been assembled before, I quote the original diagnoses of the species of *Davallodes.* A key for their determination follows:

Key to the species of Davallodes.

1. Frond and indusia not red, frond more or less hairy.
   2. Indusium fixed by base, free margin rounded, as in *Humata.*
      3. Paleæ on rhizome ferruginous ..... 1. D. **membranulosa.**
      3. Paleæ dark, aciculate.
         4. Pinnæ with short, winged stalks ..... 2. **D. gymnocarpum.**
         4. Pinnæ adnate-sessile ..... 3. **D. laxum.**
   2. Indusium fixed by base and sides, as in *Davallia.*
      3. Indusium not elongate.
         4. Pinnules merely incised.
            5. Pinnules not congested nor deeply cut ..... 4. **D. hirsutum.**
            5. Pinnules contiguous, their apices deeply toothed. **5. D. congestum.**
         4. Deeply tripinnatifid ..... 6. **D. urceolatum.**
      3. Indusium much longer than broad.
         4. Frond gradually narrowed below ..... 7. **D. dolichosorum.**
         4. Not gradually contracted below ..... 8. **D. grammatosorum.**
   2. Indusium fixed by a part of the base and pointed, as in *Cystopteris.*
      3. Stipes naked ..... 9. **D. nephrodioides.**
      3. Stipes pubescent ..... 10. **D. viscidulum.**
1. Frond and indusia reddish, glabrous except for main axes. **11. D. borneense.**

DAVALLODES MEMBRANULOSUM (Wall.) Copel., comb. nov.

Davallia membranulosa WALL., Hooker, Spec. Fil. 1 (1846) 159.

Caudex hispid with very long slender subulate rigid membranaceous scales, frond small very thin and membranaceous ovato-lanceolate and as well as the slender stipes and rachis pubescenti-hirsute bipinnate, pinnae alternate lanceolate their rachis winged, pinnules lanceolate pinnatifid, the segments ovato-lanceolate subfalcate very acute entire or rarely toothed,

involucres small ovato-subrotund acute very thin and membranaceous fixed by the broad base the rest free. (Tab. LIII. A.) *Wall. Cat. n.* 255.

Hab. Nepal, *Wallich.*—A small and very delicate species, with the habit of *Cystopteris*, but the sorus is at the apex of a vein, although the involucres are more sharp-pointed than is usual with *Davallia*. Caudex with long ferruginous narrow subulate scales. Stipes 2–3 inches high, and, as well as the rachis, which is winged above, very slender, almost filiform. Frond a span long. Primary pinnae 2 inches long, lanceolate, of a red-brown color. (*Hooker, loc. cit.*)

The plate represents an unmistakable *Davallodes*, the less aciculate scales of the rhizome not being evidently different as depicted. The indusium is most like that of *D. viscidulum*, but less pointed and more broadly attached, not at all cordate.

DAVALLODES GYMNOCARPUM Copel.

Davallodes gymnocarpum COPELAND, Philip. Journ. Sci. § C 3 (1908) 34.

Stipite 3–9 cm alto; fronde 30–40 cm alta, 12–16 cm lata, pinnis majoribus acuminatis, inferioribus sensim valde diminutis, infimis late ovatis 2–3 cm longis; segmentis [I] oblongis, rotundato-obtusis, infimis (apud rhachides) maximis, ultra mediam laminam incisis; segmentis [II] falcatis, acutis, ciliatis, infimis aliis aequalibus, integris; soris minutis, ad baseos lobarum; indusiis variabilibus, semper quam altis latioribus, non ciliatis. Tab. V.

Monte Canlaon, Insulae Negros, 600 m. s. m. *Copeland* 2075.

Easily distinguished from *D. hirsutum* by the form of the frond and that of the indusium. (*Copeland, loc. cit.*)

DAVALLODES LAXUM Copel., sp. nov. Plate 3, fig. 1.

Rhizomate (sicco) nigro, pilis nigris 6 mm longis basibus peltatis fusco-cinctis vestito; stipite 20–25 cm alto rhachique breviter castaneo- vel fusco-pilosis; fronde 30–50 cm alta, 14–18 cm lata, acuminata, tenuiter herbacea, praecipue ad costas strigosa; pinnis angustissime adnatis, maximis vix 10 cm longis, 2.0–2.5 cm latis, acuminatis, ad alam conspicuam rhachillae pinnatifidis; pseudo-pinnulis lanceolato-oblongis, haud contiguis, apice rotundatis, inferioribus regulariter medio ad costas incisis, lobis falcatis acutis, plerumque approximatis; indusiis latis, more Humatae basibus adnatis, margine libera rotundata minute et pulcherrime albido-ciliatis ciliis capitulatis, alibi glabris.

Luzon; Benguet. Merrill, "Philippine Plants," No. 957. Type in herb. E. B. C.: Bagnen, altitude 1,500 m. s. m. Copeland s. n. Nov. 1905.

Most like *D. hirsutum* in appearance, but recognizable by the comparatively remote "pinnules." The indusia are more like those of *D. gymnocarpum*, but much more evident and persistent, besides being finely ciliate.

DAVALLODES HIRSUTUM (J. Sm.: Presl) Copel.

Davallodes hirsutum (J. Sm., Presl) COPELAND, Philip. Journ. Sci. § C 3 (1908) 33.

Leucostegia hirsuta J. SM., Journ. Bot. 3 (1841) 416, nomen nudum.

Davallia ciliata HOOKER, Spec. Fil. 1 (1846) 184, pl. 60, A (non Presl, 1822).

Microlepia hirsuta PRESL, Epim. Bot. (1849) 97 (no description, but a citation of Hooker's).

Hooker's diagnosis reads as follows:

Caudex creeping crinite, frond ovato-lanceolate very flaccid membranaceous hairy especially on the veins (hairs soft silky), pinnate, pinnae from a broad base oblong acuminate bipinnatifid, primary segments oblong obtuse separated from each other almost to the rachis, ultimate ones ovate subfalcate very acute ciliated entire or with one or two minute teeth, sori small at a distance from the margin almost in the centre of a segment, involucres small half-cup-shaped ciliated, stipes and main rachis (which is rigid) pubescent with short brown hairs . . .

Hab. Luzon, *Cuming* n. 174.

Common in southern Luzon. Range in doubt because of reference of other species to this one.

DAVALLODES CONGESTUM Copel., sp. nov. Plate 3, fig. 2.

Rhizomate late scandente, pilis nigrescentibus 6 mm longis basibus peltatis pallido-cinctis vestito; stipite 10 cm alto rhachique castaneo-pubescentibus; fronde 35 cm alta, 10–12 cm lata, pinnis infimis paullo abbreviatis; pinnis horizontalibus, anguste adnatis, obtusis vel acutis haud acuminatis, basibus paullo dilatatis, ad alam 0.5–1.0 mm latam rhachillae pinnatis; pseudopinnulis oblongis, imbricatis, apicibus rotundatis argute incisodentatis dentibus acutis non falcatis; pilis ad venas aliquantum sparsis, articulatis; indusio glabro, rarius ciliis perpaucis ornato, semicupuliforme.

Mindanao, Todaya, on slopes of Mount Apo, altitude 1,200 m. s. m. Copeland No. 1481. October, 1904.

This is very near to *D. hirsutum*, but quite different in aspect because of the obtuse pinnæ and the crowded "pinnules" with deeply cut apices. The indusia of the two species are similar in form, but those of *D. congestum* are more uniformly cup-shaped and rather larger. The long hairs pictured by Hooker [2] as characteristic of *Davallia ciliata* are not present on all the plants I still construe as *D. hirsutum*.

[2] Spec. Fil. 1, pl. 60 A.

DAVALLODES URCEOLATUM Copel., sp. nov.

Rhizomate densissime pilis sordide rubido-fuscis nigrescentibus basibus peltatis vestito; stipite usque ad 15 cm alto, rhachique pube minuta fusco-fulva vestitis; fronde 30 cm alta, ovata, tripinnatifida; pinnis brevi-pedicellatis, medialibus 7 cm longis, acutis vel acuminatis, ad alam angustissimam rhachillae ubique dense puberulae pinnatis; pinnulis infimis acroscopicis maximis 2 cm longis, basiscopicis paullo minoribus, plerisque 6 mm latis, obtusis, profunde pinnatifidis; segmentis obtusis, inciso-lobatis, herbaceis, glanduloso-puberulis; soris ad segmentum quodque pinnulae 1–4; indusiis basi et apice rotundato-truncatis, apice integris vel sublaceris, lateribus adnatis sursum paullulum divergentibus.

Sumatra, Berastagi, altitude 1,500 m. s. m. Scandent on trees in ravines. H. S. Yates No. 526, May, 1923.

In the dissection of the frond more like *D. viscidulum* than any other species, but utterly different in its indusium, and much more pubescent than are my Javan specimens of that species.

DAVALLODES DOLICHOSORUM Copel., sp. nov.

Rhizomate pilis atro-rubidis 8 mm longis rectis squarrosis basibus peltatis vestito; stipite breve, 3–4 cm longo, rhachique pube breve castanea vestitis; fronde 40 cm alta, late lanceolata, utrinque angustata, acuminata, tenuiter herbacea, lamina fere glabra; pinnis medialibus 5 cm longis, 1.5 cm latis, plerisque acutis, anguste adnatis, ad alam rhachillae pubescentis pinnatifidis; segmentis oblongis, apice rotundatis, fere contiguis, inciso-serratis; pinnis inferioribus decrescentibus, infimis plus minus 1 cm longis; indusio nudo, quam lato duplo vel triplo longiore.

German New Guinea. On trees in the forest, Mount Kani, altitude 600 m. s. m. Schlechter No. 17857, June, 1908.

Judging by the sorus, this seems near to *D. grammatosorum*, of Mindanao; but it is very different in frond form, and is notable in the genus for its lack of hairiness.

DAVALLODES GRAMMATOSORUM Copel.

Davallodes grammatosorum COPELAND, Philip. Journ. Sci. § C 3 (1908) 34.

Stipite ca. 15 cm alto; fronde 40–65 cm alta, 20–26 cm lata, deorsum vix angustata; pinnis valde acuminatis; segmentis [I] lanceolato-oblongis, obtusis vel subacutis, ultra mediam laminam incisis, infimis majoribus; segmentis [II] oblongo-lanceolatis, falcatis, non ciliatis, infimis acroscopicis

maximis furcato-venosis et interdum plurisoratis; indusio ca. 0.7 mm longo, lineari-oblongo, nudo. Tab. VI.

San Ramon, Insulae Mindanao, 600 m. s. m. *Copeland* 1724; Camp Keithley, *Clemens* 1137.

This is the "*Microlepia hirsuta*" of my "Comparative Ecology of San Ramon Polypodiaceae." (*Copeland, loc. cit.*)

DAVALLODES NEPHRODIOIDES Copel., comb. nov.

Davallia (*Leucostegia*) *nephrodioides* BAKER, Journ. Linn. Soc. 24 (1887) 257.

Rhizomate late repente, paleis nigris piliformibus basi peltatis praedito, stipitibus elongatis nudis, frondibus magnis membranaceis oblongo-lanceolatis bipinnatifidis parce pilosis, pinnis lanceolatis subpetiolatis, pinnulis multijugis pectinato-pinnatifidis basi confluentibus, venis in pinnulis copiose pinnatis, soris medialibus, induso parvo reniformi.

Niah, Sarawak, *Mr. Charles Hose.*

Nearly allied to the Javan *D. Kingii* Baker, lately figured in Hooker's Icones, tab. 1622. Rhizome firm, epigaeous, ⅛ in. in diam.; paleae fine, hair-like, spreading. Stipe stiffly erect, ½ ft. long. Frond 2–3 ft. long, 8–9 in. broad at the middle, green, hairy mainly on the rhachides of the pinnae, quite destitute of scales. Pinnae subpetiolate, the central ones 4–5 in. long, 1–1¼ in. broad, the lower rather smaller, all except the lowest cuneate-truncate on the lower side at the base. Pinnules very numerous, oblique, oblongo-lanceolate, ⅜–½ in. broad, cut half way down into close ascending lanceolate lobes. Veins one to each final lobe, with a small median sorus, with a glabrous reniform indusium. (*Baker, loc. cit.*)

DAVALLODES VISCIDULUM v. A. v. R.

Davallodes viscidulum v. A. v. R., Bull. J. B. Buitenz. 2 no. I (1911) 6.

Davallia viscidula METT. in Kuhn, Linnaea 36 (1869) 145.

Rhizoma deest; folia membranacea, siccitate rufescente-olivacea, infra tenuiter pubescentia, supra una cum rhachi breviter pubescente-viscidula; rhachis rufescens; lamina 1′ longa, late ovata, pinnatisecto-tripinnatifida; segmenta primaria sessilia, 7″ longa, oblongo-lanceolata, acuminata; laciniae primariae 1½″ longae, numerosae, approximatae, trapezio-oblongae, breviter acutae, ala angusta confluentes, secundariae oblongae, obtusae contiguae ala latiore confluentes, ultimae ovatae subfalcatae, acutae, nervum indivisum s. furcatum excipientes; sori terminales, ramo externo nervi superati; indusium ovatum, acutum margine parce ciliatum.

Java (Herb. Lugd. Bat. 1452.).

Indusio ovato ab *Davallia Borneensi* Mett. (*Lastrea* Hook. Icon. pl. t. 993. *Nephrodium* Hk. spec. IV p. 111.) recedens et potius cum *D. membranulosa* congruit, a quo vero statura gigantea, lamina enim ultra 1′ longa, differt."

Davallia viscidula Mett. var. *novoguineensis* Rosenstock,[3] "Paleis rhizomatis ciliatis, indusiis latioribus quam longis a typo diversa," is probably a distinct species.

[3] Fedde's Repert 15 (1913) 526.

DAVALLODES KINGII Copel.

Davallodes Kingii COPELAND, Philip. Journ. Sci. § C 6 (1911) 147.

Davallia (*Leucostegia*) *Kingii* BAKER, in Hooker, Icones (1886) pl. 1622.

Rhizomate valido epigaeo lignoso longe repente, paleis patulis densis subulatis basi peltatis margine libero membranaceo, stipitibus erectis strictis nudis, frondibus oblongo-lanceolatis tripinnatifidis utrinque parce pilosis, rachi primaria pilosa utrinque anguste alata, pinnis lanceolatis infimis haud reductis, pinnulis oblongis adnatis profunde pinnatifidis, segmentis tertiariis contiguis oblongis, soris ad basin segmentorum solitariis, indusio ovato marginibus liberis.

Hab. Java, Mount Waringin, altitude 4,600 ft. *H. O. Forbes* (King 657).

Stipites semipedales. *Lamina* sesquipedalis, basi 9–10 poll. lata. *Pinnae* centrales et inferiores 4–5 poll. longae, 12–15 lin. latae.

A very distinct novelty, discovered in 1882 by Mr. H. O. Forbes when collecting in Java for Dr. King. It is most like the Philippine *D. ciliata* in habit, but differs totally in the structure of the indusium. (*Baker, loc. cit.*)

The wings of the rachis are questionably present on the plate which, except for the appearance of nakedness, looks exactly like *D. viscidulum*. From the statement that the new species is a very distinct novelty, and its comparison with nothing except the Philippine species, it is manifest that Baker was not conscious of the existence of *D. viscidulum* when he described this; and under these conditions he would of course have described it anew. *Davallodes Kingii* as such seems to have remained unknown since its first collection, and my belief is that it is *D. viscidulum*, the discrepancies in description being due to error, if not to variability.

DAVALLODES BORNEENSE (Hooker) Copel.

Davallodes borneense (Hooker) COPELAND, Sarawak Mus. Journ. 2 (1917) 336.

Lastrea borneensis HOOKER, Icones (1854) pl. 993.

Fronde pinnato pinnatifida (an bipinnata?) acuminata membranacea glabra, pinnis lanceolatis inferioribus longe anguste acuminatis profunde pinnatifidis, lobis oblongis acutis pinnatifido-serratis, lobulis serraturisve obtusiusculis, soris in medio venularum, involucris reniformi-orbicularibus venam centralem spectantibus, rachibus costisque pubescentibus.

Hab. Borneo, near Sarawak, *Thos. Lobb.*

. . . The veinlet on which the involucre is placed forms an angle at or near the middle, and from that angle the sorus and involucre appear to spring, . . . (*Hooker, loc. cit.*)

The frond, and more especially the indusia, have a marked reddish cast. I may be wrong in including under this name a fern much too firm in texture to be called membranaceous. The known range is Sarawak and Mount Kinabalu.

SPECIES DUBIA

Davallia (*Leucostegia*) *hosei* BAKER, Journ. of Bot. 26 (1888) 323.

Rootstock creeping, ⅛ in. diam., clothed with minute adpressed linear brown paleae. Stipes naked, brownish, 12–16 in. long. Lamina oblong-lanceolate, bipinnate, firm in texture, green and glabrous on both surfaces, 1½–2 ft. long, 5–6 in. broad. Pinnae distant, lanceolate, ascending, subsessile, ¾–1 in. broad, cut down to the rachis into unequal-sided oblong-lanceolate deeply crenate pinnules ⅛ in. broad, produced on the upper and cut away on the lower side at the base. Veins indistinct, one to each final lobe. Indusium as broad as long, rigid, glabrous, persistent, free at the sides.—Lambur, Sarawak, *Chas. Hose.* Allied to *D. Kingii, nephrodioides* and *ciliata.* (*Baker, loc. cit.*)

From the description, this would hardly be construed as a *Davallodes,* but it must be one if its affinities are correctly stated.

Failure to recognize *D. nephrodioides* and *D. Hosei* may be responsible for my belief that *D. borneensis* is a quite variable species.

Genus TROGOSTOLON Copeland, novum

Plate 4

Filix Davalliae affinis epiphytica, rhizomate late repente, paleis obscuris basibus nigris peltatis apicibus longe acicularibus rufescentibus squarrosis vestito; fronde deltoidea, glabra, in herbario subcoriacea, ad axes alatas quadri- vel quinquepinnatifida, segmentis ultimis angustis; soris quoad venam insessam abortivam terminalibus nec non saepius axillares simulantibus, utrinque vel unilateraliter cornu acuto falcato laminae excelsis; indusio firmo sed tenue, plus minus orbiculare, basi late adnato alibi libero.

Named for the resemblance of the bristly rhizome to a caterpillar.

Type and sole known species:

TROGOSTOLON FALCINELLUS (Presl) Copel. Plate 4.

Davallia falcinella PRESL, Rel. Haenk. 1 (1825) 66, pl. 11, f. 2. Philippines, from Central Luzon to Mindanao. Common in the Visayan islands.

There is considerable variation among the specimens in hand, but it is not clear that the differences characterize locally established forms or species. On some specimens minute white hairs, making the bristles of the rhizome ciliate, are conspicuous under the lens; on others these can hardly be detected and are very nearly absent. The accompanying table of generic characters shows the distinctions between this and the other genera of the group, and the several items of resemblance, as well as any discussion would do this.

Genus LEUCOSTEGIA Presl

Leucostegia PRESL, Tent. Pterid. (1836) 94.

Presl's diagnosis was in effect a description of one species, and incorporated the idea that its upper and lower surfaces have the aspect of being reversed. The type is *L. immersa.* Strikingly similar to it in color, size, dissection, habitat, and various other features is *Davallia pallida* Mett., a fern different from any other *Davallia* in habitat, paleæ, texture, texture of indusia, etc.—a clearly foreign element in *Davallia,* in spite of the fact that the sides of the indusium are affixed. It is like *L. immersa* in every respect in which it is unlike all true species of *Davallia.*

Having already in this group of genera one, *Davallodes,* with diverse indusia, I propose to enlarge the concept of *Leucostegia,* to include these two species. Each is more nearly related to the other than to any other known species. If *D. pallida* were not made a *Leucostegia,* the only proper alternative would be establishment for it of a new monotypic genus; and in my opinion its affinity to *Leucostegia* is too close and real to justify that course.

The generic characters are:

Davallioid ferns with stout, creeping rhizomes clothed with broad scales which are not black, nor aciculate nor ciliate; stipe long, light-colored, imperfectly articulate; frond ample, pinnately decompound, with broad, glabrous, herbaceous, pale green ultimate pinnules; sori dorsal in origin, but with very large pale, thin but firm indusia which may reach or surpass the margin. Normally terrestrial.

LEUCOSTEGIA IMMERSA (Wall.) Presl.

Leucostegia immersa (Wall.) PRESL, Tent. Pterid. (1836) 95.
Davallia immersa Wall., HOOKER, Spec. Fil. 1 (1846) 156.

Pinnules in general rhomboidal in outline, toothed; indusium reniform, free except for the middle of its base. Where first known, in northern India, it is a fern of moderate size, 20 to 40 cm high. A doubtfully distinct, very thin dwarf form with huge sori, not uncommon on the mountains of northern Luzon, is my var. *nana.*[4] The very large form commoner in the Philippines and Celebes is var. *amplissima* Christ.

LEUCOSTEGIA PALLIDA (Mett.) Copel., comb. nov.

Davallia pallida Mett., KUHN, Linnaea 36 (1869) 142.

[4] Philip. Journ. Sci. 1 Suppl. (1906) 147.

Pinnules in general cuneate-obovate, with a few sharp incisions; indusium cup-shaped with sides affixed, but a broad, flaring free upper part, commonly equaling the margin. Of such size as the var. *amplissima* of the preceding species.

Range, Borneo and Mindanao to Samoa.

The resemblance of these two species, however different their indusial attachment, did not escape Kuhn: "*Davalliae immersae* proxima, quae vero indusio reniformi ad latera libero gaudet."

Genus HUMATA Cavanilles

Humata CAVANILLES, Descriptiones Pl. (1802) 272.

The essential characters of this genus have been shown in the preceding outline of genera, and a study of the species is not undertaken here. I do not know the grounds on which Christensen, Index p. XXVII, selects *Adiantum repens* L. fils, as the type of the genus. To me it seems to be *H. ophioglossa* Cav., which is now construed as being *H. heterophylla* (Smith) Desv. *Humata trifoliata* Cav., construed as *H. repens* (L. f.) Diels, was the third and last species listed by Cavanilles. This question of identity of type has eventual importance because the genus can be divided into two groups of species, of which each contains one of the two suggested types.

Humata reaches its richest development in species in New Guinea, and is well represented in Polynesia and Malaya. A single species, *H. repens,* reaches to India and Japan.

Genus DAVALLIA Smith (1793)

This is the commonest, richest in species, and most widespread genus of its group, and was the first to receive generic recognition. It is therefore quite natural that it has been chosen to provide a name for the tribe or family of which it is a member. As in the case of *Humata,* its characters have already been indicated sufficiently, and I have not at hand material enough to justify a comprehensive discussion of the species. Its type is *Davallia canariensis* (L.) Sm., *Trichomanes canariense* L., a species of the Canary Islands and other islands and the mainland in the same region. The greatest wealth of species is in the Malay Region.

Judging by geographical distribution, it would seem likely to be the oldest genus of its group; it ranges from the islands of the Atlantic, across Africa, southern Asia and Malaya, to Japan, Australia, Kermadec, and Samoa, probably without a break ex-

cept where fit conditions are wanting for epiphytic life. I believe, though, that there is another, and in this instance more correct, explanation of its wide range. It is a genus very perfectly adapted to epiphytic existence without restriction to situations of great or constant humidity. In ability to thrive as an epiphyte exposed to the sun, it surpasses *Humata* in protection of the young sporangia, *Scyphularia* in that of the rhizome, and the other genera more decidedly in texture. My opinion is that these advantages have enabled it to spread farther than the other genera, without the necessary use of more time.

The confusion with it, in the history of the genus, of ferns as remote in natural affinity as *Leptolepia, Tapeinidium, Balantium,* and *Prosaptia* is a good demonstration of the natural result of dependence upon a few arbitrarily selected criteria for the purpose of general classification.

Genus SCYPHULARIA Fée

Scyphularia FÉE, Genera (1850–1852) 324.

The distinctive characters of this genus have already been made clear enough. Its nearest affinity is quite certainly to *Davallia,* but the paleæ and the undissected fronds make it decidedly expedient to remove it and leave *Davallia* without any considerably aberrant group. While the bristles of *Scyphularia* have been figured without cilia, and usually appear so under the lens, a careful study, at least in many cases, will show white or pale fibers on the paleæ, quite like those conspicuous on the paleæ of *Davallia.* The occasional forking of the lowest pinnæ is another evidence of affinity to the other genera with thick fronds.

Scyphularia ranges across the central and southern Malayan Region to as far east as Fiji. It is not known in the Philippines.

Key to species of Scyphularia.

1. Fronds pinnate.
   2. Sori long, occupying a considerable part of the lamina.
      3. Margin entire, or sori on the teeth.
         4. Margin entire or simply toothed ..... 1. **S. pentaphylla.**
         4. Margin doubly toothed ..... 2. **S. pycnocarpa.**
      3. Margin toothed, the sori between the teeth ..... 3. **S. sinusora.**
   2. Sori short, in a marginal band ..... 4. **S. triphylla.**
1. Fronds simple ..... 5. **S. simplicifolia.**

SCYPHULARIA PENTAPHYLLA (Bl.) Fée.

Scyphularia pentaphylla (Bl.) FÉE, Genera (1850–1852) 325.
Davallia pentaphylla BLUME, Enum. (1828) 232.

D. fronde ternata vel quinato-pinnata coriacea glaberrima, pinnis lanceolatis basi cuneatis inaequaliter serratis, fertilibus (ternatis) angustioribus elongatis, soris oblongis truncatis marginalibus, stipite glabro, caudice repente paleaceo-crinito . . . in sylvis Javae Provinciarum Bantam, Tjanjor etc. (*Blume, loc. cit.*)

As now construed, this species may have from one to five pairs of lateral pinnæ, with the basal ones simple or forked. The sori are large and long, the base commonly less than halfway from the costa to the margin. In Steere's Ternate collection, the base is close to the costa, so that they occupy almost the whole width of the pinnæ. It will probably be found, eventually, that several species have been given this name.

SCYPHULARIA PYCNOCARPA (Brack.) Copel., comb. nov.

Davallia pycnocarpa BRACK., U. S. Expl. Exped. 16 (1854) 242, pl. 35, f. 2.

D. rhizomate repente crinito-paleaceo; stipitibus nudis semiteretibus; frondibus deltoideo-ovatis coriaceis glabris quinato-pinnatis; pinnis subsessilibus, sterilibus lanceolatis serrulatis, fertilibus lineari-lanceolatis obtusis, infimis uni-bilobatis margine duplicato-dentatis a basi usque ad apicem creberrime soriferis; indusio oblongo apice truncato; sporangiis subexsertis; venis immersis simplicissimis vel furcatis.

Hab. Muthuata Mountains, Feejee Islands: on rocks and trunks of trees.

. . . Fronds . . . constantly quinate-pinnate; the height of the fertile one, with the stipes, from 6 to 8 inches . . . Closely related to the preceding (*D. pentaphylla*); yet distinct from it in the smaller quinate fronds, the narrower pinnae, with a doubly-toothed margin soriferous the whole length, and in the shorter and more cup-shaped indusium. (*Brackenridge, loc. cit.*)

Subsequent authors have agreed in reducing this to *S. pentaphylla*, and the differences are really not very convincing. Still, the alert collector can be expected to judge identity or difference more competently than can the herbarium worker. I have a stronger suspicion that Brackenridge erred in his determination of *S. pentaphylla* than that *S. pycnocarpa* is that species.

SCYPHULARIA SINUSORA Copel., sp. nov. Plate 5.

Species S. pentaphyllae affinis, rhizomate admodum gracile, paleis aciculatis ciliatis castaneis in vetustate cinereo-nigrescentibus glabrescentibus vestito; frondis sterilis unicae visae stipite 2 cm alto, gracile, sulcato, fronde 4.5 cm alta, triangulari-ovata, rhachi cartilagineo-alata; pinnis utroque latere duo cum impare majore, subsessilibus, oblongis, 1 cm latis, apices versus minute serratis, coriaceis, glabris; frondis fertilis stipite 5 cm

alto, fronde 12 cm alta, paullo latiore; pinnis 5, late linearibus, 1 cm latis, acutis vel acuminatis, basi inaequaliter cuneatis, serrato-dentatis, venis immersis; soris inter dentes, 2 mm longis, labio libero indusii breve, quam truncato potius rotundato.

Papua, Goodenough Bay, altitude 1,200 m. s. m. *Copeland King* No. 183 (1908).

Distinguished by the regularly obliquely dentate margin of the fertile frond, with the sori regularly placed between the teeth. Specimens regarded as *S. pentaphylla* vary from entire to coarsely toothed; but, when teeth are evident, the sori are placed on, not between, them. Absolutely, and in proportion to the part of the space between midrib and margin which they occupy, this has shorter sori than *S. pentaphylla* without, however, any near approach to their restriction to a marginal band, as in *S. triphylla.* The marked dimorphism may be peculiar to my specimen, rather than to the species; but the position of the sori may be expected to prove a dependable specific character. The paleæ, while they are still castaneous in mass color, are more ciliate than in any other *Scyphularia* I have seen, and are rather less abruptly contracted above the peltate base.

SCYPHULARIA TRIPHYLLA (Hooker) Fée.

Scyphularia triphylla (Hooker) FÉE, Genera (1850–1852) 325.
Davallia triphylla HOOKER, Spec. Fil. 1 (1846) 162, pl. 46 A.

Caudex stout creeping covered with chaffy scales, fronds coriaceous small ternate, pinnae oblong-lanceolate obtuse cuneate at the base in fertile plants more elongated all of them entire, intermediate ones petiolate, lateral ones shorter sessile oblique at the base, veins horizontally patent copious crowded parallel forked thickened flat (not prominent), involucres semicylindrical compressed crowded so as to form an uninterrupted marginal line the whole length of the pinnae . . .

Hab. Singapore, *Cuming n.* 366 . . .—Caudex with closely imbricated paleaceous scales, having long wiry points. Stipes 3–4 inches long, terminal pinna 4–5 inches long. (*Hooker, loc. cit.*)

SCYPHULARIA SIMPLICIFOLIA Copel.

Scyphularia simplicifolia COPELAND, Philip. Journ. Sci. § C 7 (1912) 64.

Frondibus simplicibus, 15 ad 25 cm altis, 35 ad 45 mm latis, fertilibus obscure crenulatis, sterilibus integerrimis, venulis haud crassis, soris 2 ad 3 mm longis, linearibus, aliter ut S. triphyllae Fée.

Sarawak, Santubong Mountain, alt. 600 m, scandent, *Brooks 133*, Oct., 1909. (*Copeland, loc. cit.*)

Still known only from the original collection.

ILLUSTRATIONS

PLATE 1

Araiostegia hymenophylloides (Blume) Copeland; *a*, entire plant; *b*, pinnule, × 5.

PLATE 2

Araiostegia yunnanensis (Christ) Copeland; *Cavalerie 7010.*

PLATE 3

FIG. 1. *Davallodes laxum* Copeland; fragment of type, × 5.
2. *Davallodes congestum* Copeland; type.

PLATE 4

Trogostolon falcinellus (Presl) Copeland; *Elmer 7066.*

PLATE 5

Scyphularia sinusora Copeland; type.

PLATE 1. ARAIOSTEGIA HYMENOPHYLLOIDES (BLUME) COPELAND.

PLATE 2. ARAIOSTEGIA YUNNANENSIS (CHRIST) COPELAND.

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PLATE 3.

PLATE 4. TROGOSTOLON FALCINELLUS (PRESL) COPELAND.

PLATE 5. SCYPHYLARIA SINUSORA COPELAND.

THE GENUS CALYMMODON

By Edwin Bingham Copeland

Of Chico, California

SIX PLATES

The genus *Calymmodon* was established by Presl,[1] as a segregate from *Polypodium* or *Grammitis,* in appreciation of the peculiar folding of the side or sides of the lobe or pinna as a protection for the sorus. For a type, he cites *Polypodium cucullatum* Nees and Blume. Evidently, he never saw the fern, for he states explicitly that he drew the diagnosis from Blume's figure. A very good figure accompanied the description of *P. cucullatum* Nees and Blume; but a very few years later Blume undertook to relocate the fern, as *Grammitis cucullata,* and published a new figure. The two figures do not seem to represent the same fern; and it was almost surely from the second one that Presl made his diagnosis. The two ferns are at any rate congeneric.

Diagnosis.—A genus of grammitid (?) ferns, of small size, epiphytic on mossy trunks in moist woods, the rhizome or caudex short, scaly, and beset with stipes and roots, the stipes not articulate; fronds pinnatifid to a winged costa or eventually pinnate, membranaceous or herbaceous, clothed with fine, pale hairs or nearly or quite glabrous, each segment with a single unbranched vein, on which the solitary sorus is borne below the apex; the sorus protected against water by the folding over it of the lower or both sides of the segment, exindusiate.

While the protection of the sorus is the conspicuous character to which the genus owes its name, the form, texture, pubescence if any, habit, and habitat are no less characteristic. It is a thoroughly natural group. There are other polypodiid ferns like these in form of frond, and even in venation, but they differ in texture and pubescence, and have distinct affinities.

Calymmodon is a distinctly Malayan genus, reaching out, as far as is now known, to Ceylon, Samoa, and Luzon. Let it

[1] Tentamen Pterid. (1836) 203.

be assumed that the pinnate *Eu-Polypodium* is a monophyletic group of world-wide distribution, and that *Grammitis* is a similar group well represented in the Tropics of both hemispheres. Both are large groups, each with a variety of minor groups of more-restricted occurrence. Almost certainly, both groups are far older than *Calymmodon* which, therefore, cannot be a link between them. If it is descended from either group, as is exceedingly probable, it is not related to the other except through that one. Its parentage is to be sought among similar ferns, of the same region, of similar habitat. Each group presents such possible parents. Blume, when he classed one of these ferns as a *Grammitis,* suggested his *G. subpinnatifida* as representing what we would now call the line of evolution; and it may so do.

Calymmodon, as here construed, is the present end of a line of evolution. When I described the genus *Acrosorus,* I regarded it as derived from *Calymmodon,* but I now believe it can be traced back to an independent source. They have therefore to be regarded as independent generic entities, or included with their parents in a very comprehensive genus. As to this, one's choice is free—to include both of these, and *Aglaomorpha,* too, in *Polypodium.* Some library botanist will of course transfer the new species of *Calymmodon* to *Polypodium;* but the time is not far off when sane botanists, in herbarium and field, will agree that, just as fast as definable monophyletic groups of reasonable size and character can be recognized, it will be better to regard them as genera than to use them to maintain such a monstrosity as *Polypodium* has become.

As a matter of definition, *Polypodium* has articulate stipes; *Calymmodon* has not. There are many species left in *Polypodium* with nonarticulate stipes; but none, so far as I know, in which the failure of the leaf to break away is quite so flagrant. In at least some of the *Calymmodon* species, the axis of the frond remains in place while all the soft parts rot and fall away, apparently having done so for decades, for the mossy forest is not a place for rapid growth. The countless, stiff, tough spines, which thus remain as an envelope of the stem, help to collect and hold the débris which helps out the plant's naturally scanty supply of mineral food, and the mosses, liverworts, algæ, etc., which collectively maintain the humidity of the mossy forest.

Key to the species of Calymmodon.

1. Fertile segments wide to the base.
  2. Segments remote, or fronds nearly naked.
    3. Wing of costa very narrow.
      4. Sterile lobes toothlike or narrow.
        5. Paleæ large, up to 5 mm long.
          6. Fronds 3–6 mm wide ..... 1. **C. cucullatus.**
          6. Fronds under 2 mm wide ..... 2. **C. pergracillimus.**
        5. Paleæ hardly over 2 mm long.
          6. Fertile segments narrowly adnate ..... 9. **C. ordinatus.**
          6. Fertile segments very broadly adnate ..... 3. **C. glabrescens.**
      4. Sterile lobes obovate, blunt ..... 4. **C. hyalinus.**
    3. Costa conspicuously winged.
      4. Sterile lobes broad, approximate.
        5. Paleæ scant and short ..... 5. **C. muscoides.**
        5. Paleæ copious and long ..... 6. **C. latealatus.**
      4. Sterile lobes narrow, remote ..... 7. **C. hygroscopicus.**
  2. Segments approximate, fronds hairy ..... 8. **C. gracilis.**
1. Fertile segments contracted below sori.
  2. Hairs pale or tawny.
    3. Contraction moderate.
      4. Sterile segments oblong ..... 9. **C. ordinatus.**
      4. Sterile segments oblanceolate ..... 10. **C. Mnioides.**
    3. Fertile part conspicuously stalked ..... 11. **C. clavifer.**
  2. Hairs dark ..... 12. **C. conduplicatus.**

CALYMMODON CUCULLATUS (Nees and Blume) Presl.

Calymmodon cucullatus (Nees and Blume) Presl, Tentamen Pterid. (1836) 204.

Polypodium cucullatum Nees and Blume, Nova Acta 1 (1823) 121.

Polypodium gracillimum Copel., Perkins' Fragmenta (1905) 189.

Polypodium subgracillimum v. A. v. R., Bull. Jard. Bot. Buitenzorg II No. 7 (1912) 40.

The diagnosis of this species was drafted by Nees; which author wrote the explanatory description is not stated. They read:

P. frondibus pinnatifidis glabris erectis linearibus, laciniis inferioribus lanceolato-dentiformibus acutis decurrentibus, superioribus ovatis obtusis cucullato-complicatis fertilibus, soro solitario.

Descr. Frons tri-quadripollicaris, angusta, linearis, adscendens, profunde pinnatifida. Stipes brevissimus, anceps, glaber, crassitie fili lintei. Laciniae alternae, 1–1½ lin. longae, inferiores e basi decurrente acutae, lanceolato-triangulares, planae, nervo medio instructae, erecto-patentes, steriles, quarum infimae minimae, dentiformes; superiores, a media fronde, fertiles, reliquis breviores sed duplo latiores, alternae, subsecundae, ovatae, obtusae, complicato-concavae et cucullatae, sorumque solitarium multicapsularem mediae costae ad basin insertum in fundo occultantes. Capsulae parvae, annulo ¾, brevi petiolo instructae. Indusium nullum.

Habitat prope *Ripanna*, Javae Insulae.

The accompanying illustration shows two entire fronds, somewhat exceeding the dimensions stated in the description, and a magnified portion showing six fertile segments, so accurately drawn that one who knows the behavior of the fern can see that the specimen was put into the press when dry enough to permit the spores to scatter. It even shows, as the description fails to do, that the lamina is very thin. The only error is Nees' statement that the fronds are erect; they may be, on the herbarium sheet. On the trunk of a tree, they stand out at first, and become pendent when at all long.

This is the most widespread and locally variable member of the group. In its fullest development, the fronds reach a width of at least 8 mm, and 6 mm is common in its ample form. The sterile segments are then linear-oblong, over 4 mm long and fully 1 mm wide, broadest above the middle, equal-sided except at the base, and rounded, obtuse or acute at the apex. The "typical" form, in the sense that the type is the thing described as a new species, has repeatedly been very much narrower, with the sterile lobes shortened until their form is dominated by the decurrent base. They are then obliquely triangular, or toothlike if somewhat longer, and always acute. This contraction may be so extreme that fronds 10 cm long are nowhere much more than 2 mm in width.

In the narrow forms, the fertile and sterile parts of the frond are similar in width. The fronds taper toward both ends, and the broadest region is likely to be about where the fertile and sterile portions meet. The costa is very narrowly winged, the decurrent base of each lobe almost disappearing before it connects with the next lobe below. The lobes are commonly separated by somewhat more than their own width, sometimes by twice this. The frond may be apparently glabrous or, especially on the costa, there may be inconspicuous pale, tawny hairs. The more ample form is likely to be more hairy. On a single plant, the leaves are usually fairly uniform—all more or less narrow, with pointed lobes, or all broader, with symmetrical lobes; but, wherever any form is common, all forms, from the narrowest to the widest, may be expected. I have collected them together on Apo, back of San Ramon, on Banahao, and on Pulog, and the Owen Bryant Expedition did the same on the Gedé.

In the mossy forest, throughout the Malay region.

CALYMMODON PERGRACILLMUS (v. A. v. R.) Copel., comb. nov. Plate 1.

Polypodium pergracillimum v. A. v. R., Bull. Jard. Bot. Buitenzorg II 20 (1915) 23.

Eupolypodium, Pinnatifida.—P. subgracillimo v. A. v. R. affine sed frondibus angustioribus, ca. 1–2 mm latis, segmentis sterilibus oblique brevideltoideis, decurrentibus, apice recurvatis. (*v. A. van Rosenburgh, loc. cit.*)

Dutch New Guinea.

A specimen collected by C. Boden Kloss, the subject of the accompanying Plate 1, is confidently referred to this species. The rhizome is notably long, and the aggregation of fronds correspondingly dense. The sterile teeth are a fraction of a millimeter wide, separated by many times their own width, and connected by an almost obsolete wing. To provide a place for a sorus, and any lamina to fold up beside it, the fertile segments are necessarily much larger than the sterile; but even these are as small as they well can be. The paleæ are like those of *C. cucullatus,* or somewhat broader—so large that they are evident in the photograph (X).

CALYMMODON GLABRESCENS Copel., sp. nov. Plate 2.

Caudice parva, paleis ferrugineis 2 mm longis 0.5 mm latis apiculatis basibus auriculato-cordatis inter radices et baseos stipitum vestito; stipitibus dense caespitosis, brevibus, aut usque aut fere ad caudicem angustissime alatis, rhachibusque pilis albidis minutis paucis et caducis ornatis; fronde 6–10 cm alta, 7– (rarius) 10 mm lata, herbacea, pilis brevissimis plerisque mox caducis ornata; segmentis sterilibus oblongis, obtusis vel apice rotundatis, plerumque ca. 4 mm longis, 1.3 mm latis, spatio aequilato separatis, basi late adnatis, decurrentibus et ala angusta connexis; segmentis fertilibus brevioribus, latioribus at latius ad alam latiorem adnatis.

Ceylon. Beckett No. 265. Type, in Herb. Kew. On trees, altitude 900–1,800 m. s. m.

This is nearer to the real *C. cucullatus* than to any other species. It bears no hairs as long as those of which that species often has a few, but may bear more numerous, very minute ones. It shows no sign of the narrow form with tooth-like segments, and is not so lax nor so elongate as the more ample form of *C. cucullatus;* and the fertile segments are relatively shorter and more rounded. The most outstanding single difference is in the paleæ, those of *C. cucullatus* being more than twice as long and rather paler. None of the two dozen plants sent me is nearly as hairy as is represented by Beddome's

diagrammatic figures; and the resemblance to *C. gracilis*, rather than to *C. cucullatus*, suggested by his sketch and description, does not really exist.

CALYMMODON HYALINUS Copel., sp. nov. Plate 3.

Caudice vix 0.6 mm crasso, paleis ferrugineis aequilatis lanceolatis vestito; stipitibus confertis, usque ad 5 mm longis, nigrescentibus, sparse pilosis fronde vix 5 cm longa, 7 mm lata, ad alam angustam pinnatifida, praecipue ad costam sparse pilosa, membranacea; lobis sterilibus anguste obovatis, usque ad 1.5 mm latis, spatio angustiore separatis, apicibus late rotundatis; fertilibus paullo brevioribus, similiter latis et rotundatis, et siccis conduplicatis.

Sarawak, Mount Bengkarum, altitude 1,050 m. l., C. J. Brooks (1908).

Mr. Brooks sent this to me with the note that he could identify it with no known species, but I mistook it then for *C. cucullatus*. It is most like *C. gracilis*, but differs in being less hairy, with relatively broad lobes and narrow wing along the costa, as well as in size. Small as the fronds are—and the diagnosis fits the largest seen—the specimens are fruiting freely. The caudex is less buried in old stipes and rachises than in other known species. In hairiness and in the vanishing wing, this is very like *C. cucullatus*, but differs in having the lobes comparatively broad and close together.

CALYMMODON MUSCOIDES Copel.

Polypodium muscoides COPEL., Elm. Leafl. Philip. Bot. 3 (1910) 839.

The original description reads:

P. gregis P. cucullati, minutum; rhizomate breve, erecto; stipitibus brevibus, confertis, haud articulatis; fronde usque ad 5 cm (plerumque ca. 3 cm) longa, 3 mm lata, ad costam alatam in segmenta ob partes inferiores infraflexas triangularia 1 mm lata proxima pinnatifida; soro solitario, more P. cucullati protecto.

Mount Apo, altitude 2,150 m., forming dense soft patches at the base of mossy trunks.

I have in hand only Elmer's type collection, but have once identified a Kinabalu plant as the same. The fronds are uniformly small, dark green, rather stiff, chiefly because of the hard but very fine costa, sparsely clothed when young with minute hairs, whitish like those of *C. gracilis* but incomparably smaller. The sterile segments (cf. diagnosis) are of course not folded; the lowest are toothlike; the others also are quite oblique, short-oblong when most ample, rounded or subacute, and sep-

arated by less than their own width. Van Alderwerelt's figure of them [2] is good. The rhizome is densely beset with stipe-bases and roots, and longer remnants of stipes and rachises. If these are dissected away, a few minute, fuscous scales are found, a fraction of a millimeter long, and apparently broadly lanceolate. The sori are large enough to fill and protrude from the cavity of the folded fertile segments.

CALYMMODON LATEALATUS Copel., sp. nov. Plate 4.

Rhizomate gracile, paleis castaneo-ferrugineis lineari-lanceolatis 2 mm longis vestito; frondibus subsessilibus, linearibus, 4–7—et usque ad 25—cm longis, 3–4 mm latis, ad alam latam costae pinnatifidis, herbaceis, pallide viridibus, pilis brevissimis sparsissime pilosis et ciliatis; segmentis sterilibus obliquis, infimis breviter serraeformibus, sequentibus approximatis breviter oblongis subrotundatis; fertilibus haud reductis, dum modo expansis imbricatis, soro lamina ampla occulto.

Apia. No. 107 of the Praeger Herb. Type in Herb. Calif. Acad. Sci. Collected Aug. 6, 1880, presumably by Betsche (largest fronds 7 cm long); much larger specimens in Kew herbarium, collected in Samoa by Horne, and by Powell. Also, Horne No. 1026, apparently from Fiji.

Very similar to *C. muscoides,* but distinctly lighter in color, the costa more broadly winged, the pubescence still more minute, and particularly distinguished by the scaliness of the rhizome. Both species appear glabrous until carefully studied.

CALYMMODON HYGROSCOPICUS Copel., sp. nov. Plate 5.

Caudice gracile, 1–1.5 mm crasso, more generis stipitibus, rhachibus frondium emortuarum et radicibus profunde tecto, paleis fusco-ferrugineis sat grandibus ad apices lobuliferis et ibidem barbatis vestito; frondibus densissime glomeratis, stipitibus, si tales distinguendi sunt, 1 cm longis, fere ad caudicem alatis; fronde 6–9 cm longa, 5 mm lata, ad alam conspicuam pinnatifida, glabra, herbacea; lobis sterilibus oblongis, 1–1.3 mm latis, obtusis, inter se 1.5 mm distantibus; fertilibus gradatim abbreviatis, infra soros non angustatis; soro mediale, interdum venulam secus subelongato.

Papua, "behind Wedan," King No. 475.

The wing along the costa is distinctly wider than in most species, but still not as wide, in proportion to the size of the frond, as in *C. muscoides,* from which it differs essentially in the

[2] Bull. Jard. Bot. Buitenzorg II 7 (1912) pl. 3, fig. 3.

elongate lobes. These are broader and less remote than in *C. cucullatus*. The texture is more substantial than in other species.

POLYPODIUM CALYMMODON v. A. v. R.

Polypodium Calymmodon v. A. v. R., Malayan Ferns Suppl.

I give this a place here because I do not know how to reduce it to any other species, and may not ignore what is seriously presented in as useful a work as van Alderwerelt's. The plant, if such there be, is distinct from all others of its group, in having the fertile segments distinctly longer than the sterile. For this distinction, a drawing by "Sixtus" [3] is the sole authority, unsupported by Blume's text. Nevertheless, van Alderwerelt presents a full description of a plant, and endows it with a name, "*Polypodium Calymmodon* Fée," without citation of its source. Fée's diagnosis, which van Alderwerelt explains that he did not see, hardly existed. Fée had previously described the hairy Philippine relative as *Plectopteris gracilis*. He then [4] rechristened *Polypodium cucullatum* Nees and Blume, citing the synonyms up to his time, as *Plectopteris Calymmodon*. He had no more seen the fern in question than had Presl; but he distinguished it from his *P. gracilis* thus: "Fronde pinnatifide, coriace, à segments fertiles unilatéraux; les fertiles six fois plus petits que les stériles." Thus a manifestly inaccurate picture (for the fertile segments in the picture of "*Grammitis cucullata*" are like nothing in nature), unsupported by text, made by an otherwise unknown penman, which never did represent a distinct plant except on the assumption that Blume misconstrued his own species, has given rise to a library species, characterized by very large fertile lobes, but equipped with a name invented for another library species with freakishly small ones. Requiescat in pace.

CALYMMODON GRACILIS (Fée) Copel., comb. nov.

Plectopteris gracilis FÉE, Genera Fil. (1850–1852) 230.
Calymmodon hirtus BRACK., U. S. Expl. Exped. 16 (1854) 2.
Polypodium consociatum v. A. v. R., Bull. Jard. Bot. Buitenzorg II 7 (1912) 41.
Polypodium cucullatum of many writers, not of Nees and Blume.

Fée distinguished this from Blume's plant, his *P. Calymmodon*, by thinner texture, hairiness, and fertile segments slightly

[3] Blume, Flora Javae 2, pl. 50, f. 3. [4] Huitième Mémoire (1857) 124.

smaller than the sterile. For substantially the same reasons, Brackenridge and van Alderwerelt in turn described it as new, using type material from the same place. The sterile segments are notably ample, for the genus, longer than broad, with rounded apices, and separated by very narrow sinuses.

This is one of the commonest epiphytes of the mossy forest on all Philippine mountains, and I refer to it a very similar Bornean plant.

Polypodium cucullatum var. *planum* Copel., is probably based on immature fronds of mature plants. The segments develop their hygroscopic movement only as the sporangia mature.

CALYMMODON ORDINATUS Copel., sp. nov.

Rhizomate paleis brunneis lanceolatis basibus auriculato-cordatis 1.5 mm longis 0.25 mm latis rarius majoribus inter baseos permultos stipitum vestito; stipitibus caespitosis perdurantibus mox exalatis brevibus; fronde ca. 6 cm longa, deorsum (sterile) 5–7 mm, sursum (fertile) 3–4 mm lata, rhachi gracile rigida anguste alata minute decidue pubescente; segmentis sterilibus anguste oblongis, 3–4 mm longis, vix 1 mm latis, apice rotundatis, herbaceis, firmis, pilis fulvis ca. 0.3 mm longis caducis praeditis, inter se 1 mm (sursum) vel 2 mm (deorsum) distantibus; segmentis fertilibus valde dilatatis, brevibus, acutis, infra sorum modo contractis sed haud pedicellatis, conduplicatis spatio angusto regulariter separatis, explanatis (qua conditione haud naturale) imbricatis; soro lateribus segmentorum latis omnino involuto.

Luzon, Caraballo Mountain, Nueva Vizcaya Province, *Loher s. n.* (1915).

Smaller throughout than *C. gracilis*, and with smaller, less persistent hairs; fertile segments broader but less broadly adnate than in *C. cucullatus;* different from both in firmness of texture and smaller paleæ.

CALYMMODON MNIOIDES Copel., sp. nov. Plate 6.

Caudice elongato gracile, sed ob tegmen profundum ex stipitibus permultis nunquam desinentibus radicibusque confectum columnam validam simulante, paleis ferrugineis obtusis apicibus ciliatis vestito; frondibus multis, tenuiter herbaceis, glabris, ad alam angustissimam costae pinnatifidis, 2–3 cm longis, 5–8 mm latis; segmentis sterilibus oblanceolatis, 1 mm latis, obtusis; fertilibus fere aequilongis, lamina protectrice sori dilatata, costam versus angustatis nullibi lamina carente.

Kaiser Wilhelmsland, in the woods of the Kani Range, altitude 1,000 m. Schlechter No. 17200 (Jan., 1908).

Distributed as *P. clavifer* Hooker, which is a much larger fern, with the fertile segments or pinnæ far more sharply differentiated. In *C. mnioides*, the lower part of these is merely narrowed, and the narrow part is decidedly shorter than the dilated part. In *C. clavifer*, the stalklike portion is approximately as long as the wide part, or even longer, and the contraction goes as far as the complete elimination of the lamina, making this part of the frond truly pinnate.

CALYMMODON CLAVIFER (Hooker) Moore.

Grammitis clavifer HOOKER, 2d Century (1860) 5.
Polypodium clavifer HOOKER, Sp. Fil. 4 (1862) 176.

Caudex rather stout ascending copiously rooting, fronds scarcely stipitate densely crowded caespitose 4–5 inches long firm rigid-membranaceous narrow- or linear-lanceolate acuminate pinnate, pinnae remote patent terminated by 1–3 long setae, *sterile* ones very narrow linear, *fertile* spathulate acute concave the superior margin reflexed, veins solitary simple in each pinna not reaching to the apex soriferous below its extremity occupying the dilated portion of the pinna, rachis very hispid having a narrow wing on each side connecting the pinnae (or the whole frond may be considered deeply pinnatifid).

The original collection was on Mount Kinabalu. It has been found there repeatedly, and once on Mount Apo, in Mindanao, and has been reported from New Guinea.

The stalklike lower part of each "pinna," as long as the dilated portion, and so contracted that any wing on the vein is hardly visible to the naked eye, gives this fern a very remarkable appearance. My reason for mistrusting reports of its occurrence in New Guinea has been given in the discussion of the preceding species.

CALYMMODON CONDUPLICATUM (Brause) Copel., comb. nov.

Polypodium conduplicatum BRAUSE, Engler's Jahrb. 49 (1912) 41, p. 31, fig. 2J.

Eupolypodium. Rhizoma adscendens, pilis fuscis vestitum. Folia numerosa, fasciculata, petiolulata. Petioli validi, teretes, anguste alati- 3–5 mm longi, juventute pilis longis fuscis instructi. Laminae 3–6 cm longae, usque ad 4 mm latae, lineari-lanceolatae, in apicem obtusum desinentes, ad basin versus decrescentes, chartaceae, utrinque pilis longis fuscis armatae, pinnatae; pinnis (lobis) patentibus, interstitiis cr. 1 mm longis disjunctis, integris, alternis, inferioribus sterilibus linearibus vel cuneatis, usque ad 3 mm longis, vix 0.3 mm latis, superioribus fertilibus paulum brevioribus quam steriles, 1.5–2 mm longis, usque ad 1 mm dilatatis, ovoideis, apice acutis, piliferis; rachibus angustissime alatis, pilis longis ornatis; nervis simplicibus. Sori solitarii in lobis, lobis conduplicatis involuti.

Northeast New Guinea, in forests on the Bismarck Range.

Distinguished from *C. clavifer* most essentially by the pubescence, which is so peculiar in *Calymmodon* as to suggest a different descent; also, the development of the "key-like" appearance has not gone nearly so far.

For the use, in this study of *Calymmodon*, of facilities other than those of the University of California and of my own herbarium, I wish to express appreciation of the courtesy of Directors Hill and Diels of the Royal Botanic Gardens at Kew and Dahlem, in placing in my hands material otherwise quite inaccessible, and to Miss Eastwood for similar courtesy on the part of the California Academy of Science.

ILLUSTRATIONS

[Photographs by Matthews.]

PLATE 1. *Calymmodon pergracillimus* van Alderwerelt van Rosenburgh. Collected by C. Boden Kloss.
2. *Calymmodon glabrescens* Copeland. Type.
3. *Calymmodon hyalinus* Copeland. Type.
4. *Calymmodon latealatus* Copeland. Type.
5. *Calymmodon hygroscopicus* Copeland. Type.
6. *Calymmodon mnioides* Copeland. Type.

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PLATE 1. CALYMMODON PERGRACILLIMUM van ALDERWERELT van ROSENBURGH.

PLATE 2. CALYMMODON GLABRESCENS COPELAND, TYPE.

PLATE 3. CALYMMODON HYALINUS COPELAND, TYPE.

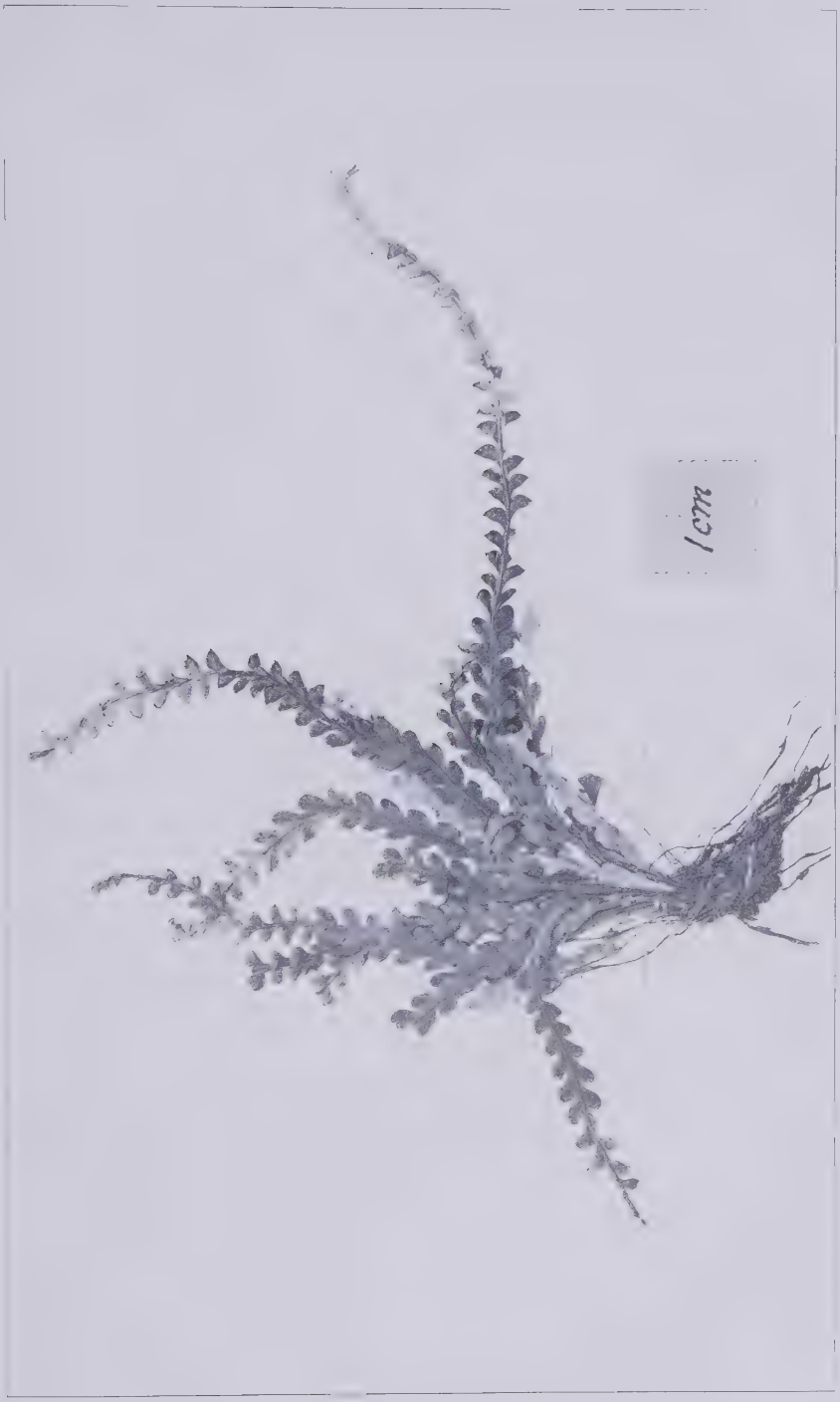


PLATE 4. CALYMMODON LATEALATUS COPELAND, TYPE.

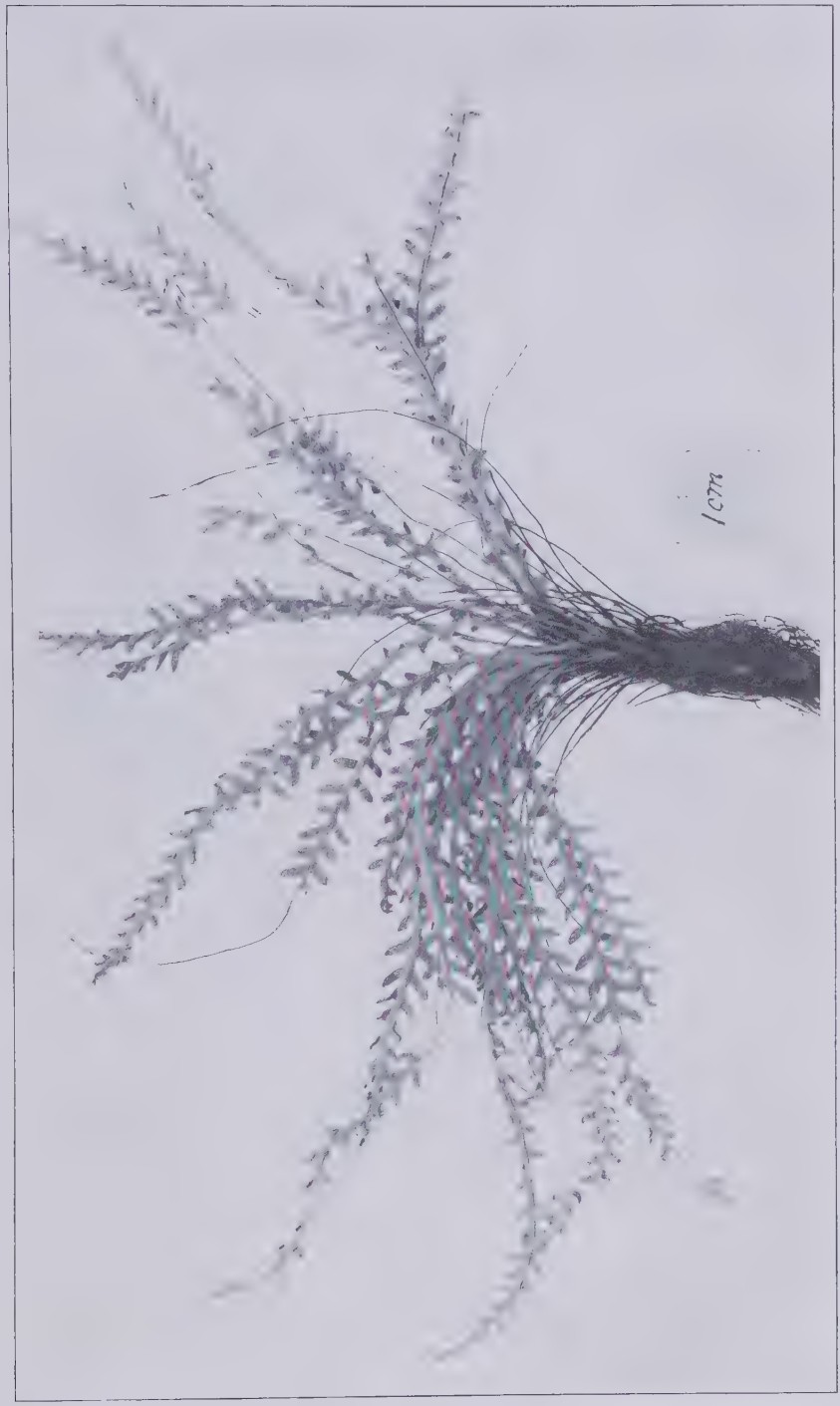


PLATE 5. CALYMMODON HYGROSCOPICUS COPELAND, TYPE.

PLATE 6. CALYMMODON MNIOIDES COPELAND, TYPE.

FOUR NEW FISHES FROM LAKE TAAL (BOMBON)[1]

By Albert W. Herre

Chief, Division of Fisheries, Bureau of Science, Manila

THREE PLATES

HARENGULA TAWILIS Herre, sp. nov.

Branchiostegals, 6; dorsal, 17 to 18; anal, 19 to 21; pectoral, 16 or 15; ventral, 8; scales in lateral series, 38 to 40; in transverse series, 11 or 12; gill rakers 50–60+35–37; preventral abdominal scutes, 18; postventral, 12.

The elongate body strongly compressed laterally, ventral profile much more convex than dorsal; covered with hard, closely and firmly attached scales each with 3 vertical lines, the free edge irregularly erose; belly strongly compressed, serrate, each abdominal scute terminating in a sharp spine; depth 3 to 3.5 times, the laterally flattened head 3.5 to 3.9 times in length; orbital space around the circular eye elongated anteriorly, the eye proper 3.22 to 3.66 times in head, the entire orbital space 2.63 to 3 times in head, more than twice as long as the blunt and very slightly emarginate snout, which is 6.6 to 7.25 times in head; the maxillary is very broad posteriorly, covering most of mandible, and extends beneath anterior portion of pupil or beyond a perpendicular from its middle, 2.4 to 2.5 times in head; prominent ridges and striæ above eyes; 5 to 7 or more longitudinal striæ on top of head on each side behind interorbital space; height of operculum three times its width; origin of dorsal nearer to snout than insertion of dorsal is to caudal, or they may be equal; length of dorsal base equal to, or slightly more or less than its height, which is 5.5 to 6 times in its length and about 1.7 times in depth of body; the low anal only 0.3 as high as the dorsal, its base exceeding or equal to that of dorsal; the slender pointed pectoral 1.33 to 1.45 times in head; origin of ventrals below middle or posterior part of dorsal; caudal covered with small scales over most of its length and deeply incised

[1] Bombon is the Tagalog name of the lake and the name by which it was known to the Spaniards. Taal is the name of the volcano and city.

with pointed lobes, 3.7 to 3.9 in length; teeth little evident, rarely present on upper jaw, but usually visible on lower jaw, tongue, palatines, and pterygoids.

Color metallic steel blue with a silvery luster along back, shining silver elsewhere; tips and inner margins of caudal lobes blackish; first dorsal butter yellow with a black spot at origin, and upper half thickly specked with black or a black spot above anteriorly; the other fins colorless, or the pectoral with a fine black line along its upper margin.

Here described from the type, No. 13198, in the Bureau of Science collection, and 77 cotypes, from 78 to 128 millimeters in length, collected at various times and places in Lake Taal. My largest specimens are nearly ripe females.

This sardine breeds in Lake Taal and is not known elsewhere. It has never been taken in the great fish corrals in the outlet of the lake. It is largely caught by drift gill nets, set with the float line a short distance below the surface of the lake. The chief center of the fishery for this sardine is at Talisay, but the sardines are mainly caught around Volcano Island. They are caught at all times throughout the year. Some of my specimens had been feeding on young silversides, *Hepsetia balabacensis* (Seale), which is common in the lake.

Large quantities of this fish are consumed fresh, but they are also dried, though of course they make a very inferior product. In times of plenty they are also cooked with vinegar, wrapped in banana leaves, and shipped to interior points in Batangas Province and to the towns along Laguna de Bay in Laguna Province. Prepared in this way they will keep for three days.

Tawilis is the local Tagalog name.

Genus BOMBONIA Herre, novum

Elongate, slender, head moderate, trunk short, tail very elongate, slender; shields sculptured and corrugated; a prominent keel on belly; anal fin wanting; pectorals and caudal small; dorsal entirely on anterior part of tail; superior cristæ of trunk and tail discontinuous; inferior cristæ of trunk and tail continuous; median cristæ of trunk usually curved downward at posterior extremity and then subcontinuous with inferior cristæ of tail; shields of occiput and nape with a median crest; a median longitudinal keel on operculum.

Eggs small, numerous, carried on the undersurface of the tail of the male, protected by a fold of skin on each side, their free borders very close together or even coalescing.

This genus is sufficiently distinguished from others by the absence of the anal fin.

Known only from Lake Taal, or Bombon, a large fresh-water lake in Batangas Province, Luzon, for which the genus is named.

BOMBONIA LUZONICA Herre, sp. nov.

Dorsal, 23 or 22; anal wanting; pectoral, 14; caudal, 6; rings, 15+37; subdorsal rings, 6.

The angular elongate slender form narrower on dorsal surface than below, trunk heptagonal, the very long tail four-sided; all the plates are finely sculptured with fine ridges; on the belly is a conspicuous knifelike keel, made up of sculptured plates, its height equal to half an eye diameter; greatest depth without keel 17.09 times in length; trunk short, 4.08+ times in length, 2.63 times in the very long tail, which is nearly two-thirds total length, or 1.55+ times in total; head conical posteriorly, 8.95+ times in length, 2.19 times in trunk; the large elongate snout very narrow with concave plates below, enlarged anteriorly, 2.18 times in head; distance from center of eye to tip of snout greater than distance from same point to posterior extremity of head; eye 5.25 times in head, 2.4 times in snout; operculum has a prominent median longitudinal keel, with many fine radiating or transverse ridges below it; a small horizontal spine on middle of anterior rim of eye; a longitudinal crest on each side of top of head, running forward above eyes and on snout for about half its length; a median crest on nape, one on top of head to eyes, and another from anterior part of interorbital space forward on snout for more than half its length; dorsal confined to the first six rings of tail.

Color in alcohol uniform dusky greenish gray, the ventral keel and caudal fin blackish; underside of head whitish.

Here described from the type, a male 94 millimeters long, bearing eggs, and 32 specimens, 43 to 87 millimeters long. Another male, 85 millimeters long, also carried eggs. Only adults have a well-developed ventral keel. Specimens less than 60 millimeters in length are very slender. A few specimens have a few dark spots under the chin or obscure marks on the sides of the head posteriorly.

This unique little fish was obtained in Lake Taal, between Ambulong and Talisay. It lives in the eel grass.

Careful scrutiny with a compound microscope fails to show any trace of an anal fin.

Luzonica, from Luzon.

RHINOGOBIUS FLAVOVENTRIS Herre, sp. nov.

Dorsal, VI–1–10; anal, 1–11; 26 scales in a longitudinal series, 8 in a transverse series.

Body wedge-shaped from above, depth at origin of first dorsal 4.5 to 5.3 times in length; the large head much broader than the trunk, its length 3 to 3.25 times in total length; opercles end in a large thin flap which totally covers pectoral base; the large eyes close together, laterodorsal, largely upward gazing, 4 to 4.3 times in head, interorbital space narrow, smooth, about 4 times in an eye diameter; upper anterior profile gently sloping from origin of dorsal to eyes, the short rounded snout strongly convex, 1.5 times in eye and 6.25 to 6.5 times in head; the oblique mouth very large, jaws curved, posterior angle of maxillary extending to a point beneath center or posterior margin of eye; 4 rows of teeth in front of each jaw, the outer and inner rows enlarged, the two middle rows very small, the innermost row recurved; the teeth in each jaw dwindle to a single row posteriorly; body covered with firm ctenoid scales, head, predorsal region, pectoral base, breast, and median portion of belly naked; first dorsal reaches base of first anal ray when depressed, third dorsal spine usually the longest, although the fourth is often as long and the second rarely equals it, twice or a little more or less than twice in head; second dorsal of nearly uniform height, the last ray usually a little elongate and often reaching caudal when depressed, the last ray scarcely as long as the highest dorsal spine; anal of almost uniform height, 2.5 to 2.6 times in head, its base longer than that of second dorsal; the caudal usually appears pointed but is really bluntly rounded, caudal, pectoral, and ventral of equal length, about 0.7 to 0.75 of head; the broad ventral has a dissected serrate margin and extends to base of second anal ray.

Color in alcohol butter yellow on belly and lower part of sides, dorsal half gray with 5 blackish crossbands on body, alternating with 5 large black spots on middle of side from beneath pectoral to base of caudal; scales on dorsal half more or less margined with blackish; a black spot on top of head behind interorbital, between eye and angle of mouth, and on opercle; entire head with fine black dots; pectorals and caudal heavily crossbarred with black; first dorsal heavily marked with black dots, and with a

white spot or spots on upper half behind fourth spine; second dorsal black or black spotted; outer half of anal black, inner half yellow; ventrals uniformly black. The yellow may change to white or gray in alcohol.

Here described from 37 specimens, 25 to 37 millimeters long, collected in Lake Taal, Luzon.

PETROSCIRTES FEROX Herre, sp. nov.

Dorsal, 32 to 36, mostly 33 or 34; anal, 24; pectoral, 12; caudal, 12, not counting the short accessory rays; ventral, 2.

The wedge-shaped elongate body laterally compressed, greatest depth just back of pectoral base, 5.5 to 6 times in length; dorsal profile nearly horizontal, highest at origin of dorsal and descending at a very slight angle in a straight line to caudal base; ventral profile strongly convex below head and belly, then ascending in a moderate straight incline to caudal base; upper anterior profile of head boldly convex; width of head greater than that of body, its length 4.9 to 5.2 times in total length; eye moderate, high up, rarely even with profile, 3.66 to 4 times in head, equal to the steeply curved snout; interorbital width equals half or two-thirds eye; mouth low down, inferior, apparently very small, the lip concealing its posterior angle which is beneath anterior margin of eye; 16 to 18 teeth in upper jaw, 18 in lower jaw; a long stout recurved canine tooth on each side of both jaws, the lower canines much the larger, their length equal to or greater than diameter of pupil of eye; no tentacles or barbels; width of gill opening two-thirds or less than that of pectoral base, at least half its breadth above pectoral base; dorsal and anal extend to, but not upon caudal; dorsal of almost uniform height, equal to or greater than an eye diameter in vertical height, posterior rays elongate and equal to depth, but curved backward so that their vertical height is little or not at all greater than the preceding rays; anal also of almost uniform height, about two-thirds as high as dorsal; origin of anal much nearer tip of snout than caudal, the length of its base 1.5 to 2 times in total length; the pointed pectoral 0.8 to 0.9 length of head; the rounded caudal equals depth; the long thread-like ventral rays may reach anus but usually fall short, 4.66 to 4.9 times in length; equal to or a little longer than head.

Color in alcohol varies from light brown to brownish green or brownish gray, the underparts paler, body crossed by about nine darker vertical bars; often the bars, especially the forward ones, are angled, the point of the angle directed forward; dorsal,

anal, and caudal uniform dark brown, or concolorous with body; pectoral pale, ventrals whitish.

Here described from 60 specimens, 31 to 56 millimeters in length, from the vicinity of Ambulong, Talisay, and around Volcano Island, all in Lake Taal. They live amid stones and gravel. When held in the hand they will snap at skin or finger nails and hang suspended by their teeth.

Ferox, ferocious, in allusion to their propensity to seize hold with their fangs.

ILLUSTRATIONS

PLATE 1

Harengula tawilis. (Drawing by A. L. Canlas.)

PLATE 2

FIG. 1. *Bombonia luzonica* Herre sp. nov., adult male, lateral aspect. (Drawing by Jose Nievera.)
2. *Bombonia luzonica* Herre sp. nov., adult male, ventral aspect. (Drawing by Jose Nievera.)

PLATE 3

FIG. 1. *Rhinogobius flavoventris* Herre sp. nov. (Drawing by P. Bravo.)
2. *Petroscirtes ferox* Herre sp. nov. (Drawing by Jose Nievera.)
3. *Petroscirtes ferox* Herre sp. nov., enlarged, to show the teeth. (Drawing by Jose Nievera.)

PLATE 1.

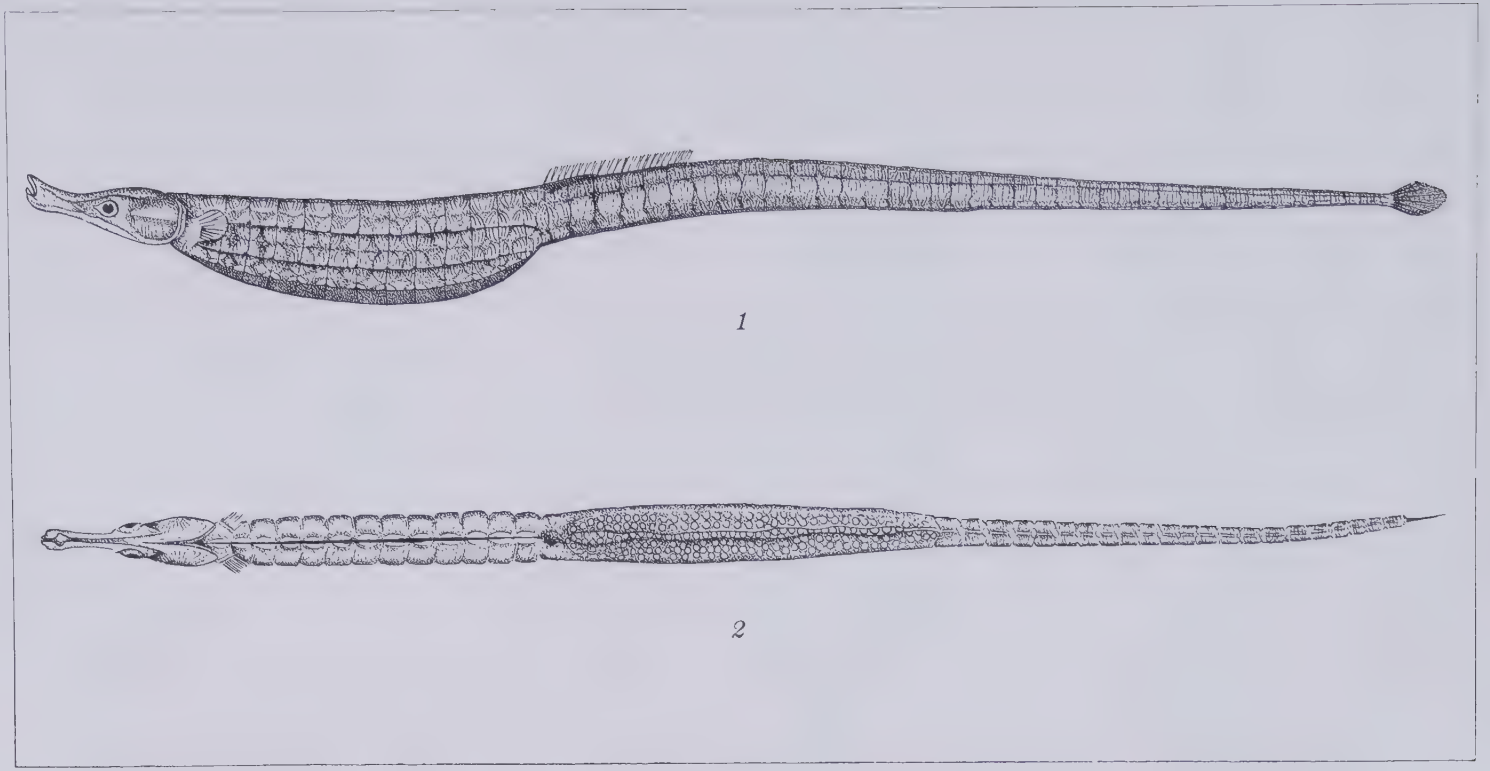
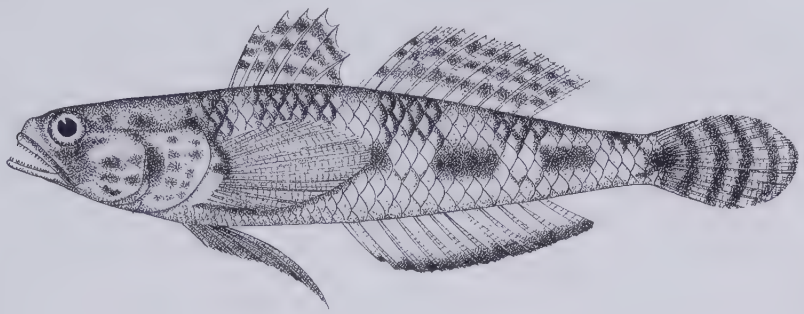


PLATE 2.



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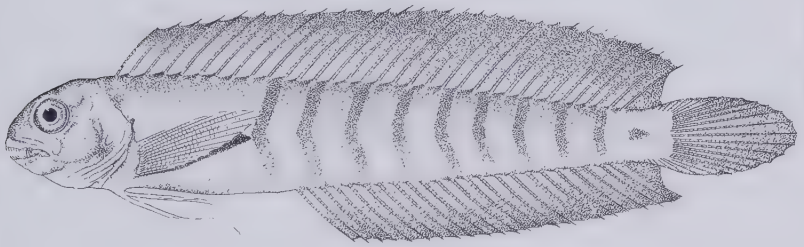

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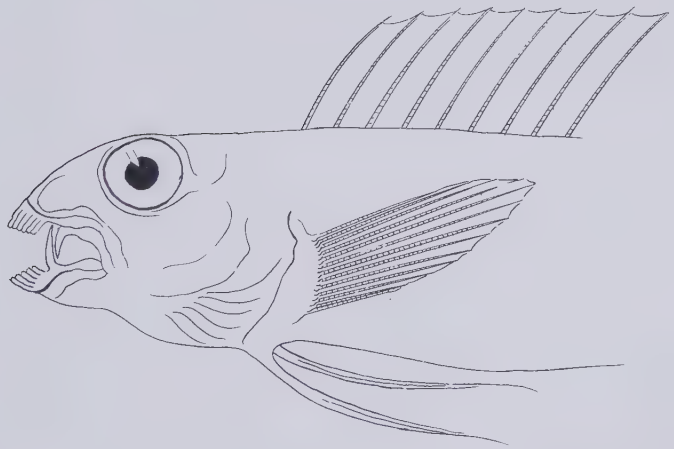

3

PLATE 3.

THE PHILIPPINE BAND FISHES

By ALBERT W. HERRE

Chief, Division of Fisheries, Bureau of Science, Manila

ONE PLATE

CEPOLIDÆ

BANDFISHES

The very elongate, band-shaped body covered with small to minute cycloid scales. Head blunt, with large lateral eyes, a large and very oblique mouth, and projecting chin; teeth of moderate size, in one or two rows, those above on premaxillaries only; none on vomer or palatines. The lateral line ascends from the supraopercular groove to base of dorsal and thence backward, usually obscure.

Dorsal and anal fins very long, composed of slender soft rays, either simple or branched and more or less distinctly articulated; both fins more or less united to the slender, elongate caudal; ventrals thoracic, of one spine and five rays. Bones of skull well ossified, suborbitals not articulated with preopercle; caudal vertebræ exceedingly numerous. Gill openings wide, gill membranes free or scarcely united with isthmus; gills 4; pseudobranchiæ present; branchiostegals 6; air bladder large; pyloric cæca few.

Small fishes of a deep red color, one or two species very handsome, of no economic importance to man. One European, three Japanese, one Indian, and one East Indian species, the last variable in color. At least one Japanese species and the East Indian species occur in the Philippines.

Two genera are known, *Cepola* and *Acanthocepola,* the latter distinguished by having four to eight spines on the lower margin of the preopercle.

Genus ACANTHOCEPOLA Bleeker

Acanthocepola BLEEKER, Versl. Akad. Amsterdam 8 (1874) 369.

In addition to the character of the preopercle, mentioned above, the dorsal rays are simple and indistinctly articulate.

Key to the Philippine species of Acanthocepola.

Dorsal 68–74; anal 72–74; caudal 13; head 6 or 7 in length.
A. abbreviata.

Dorsal 80–92; anal 78–92; caudal 14; head 8 to 10 in length.
A. krusensterni.

ACANTHOCEPOLA ABBREVIATA (Cuvier and Valenciennes).

Cepola abbreviata CUVIER and VALENCIENNES, Hist. Nat. Poiss. 10 (1835) 298; CANTOR, Cat. Malayan Fishes, Journ. Royal Asiat. Soc. Bengal 18 (1849) 178; GÜNTHER, Cat. Fishes 3 (1861) 488; DAY, Fishes of India (1878) 324, pl. 68, fig. 4; JORDAN and SEALE, Bull. Bur. Fisheries 26 (1907) 27; WEBER, Fische Siboga Exp. (1913) 266.

Dorsal 68–72; anal 70–74; caudal 13; scales in lateral line about 145; scales in longitudinal series 165 to 175.

The strongly compressed body becomes much narrower and thinner posteriorly and ribbonlike, head about 6.5 times in length and equal to depth; eyes very large, their upper margin almost reaching profile or forming a part of it, 2.66 to 2.7 times in head; snout short, with a central hump, 1.75 times in eye; maxilla very broad posteriorly, its greatest width three-fourths that of eye, its posterior angle beneath pupil of eye; a single row of teeth in each jaw; preopercle has a strong spine at its angle, and three or four more along its lower limb, the number often different on the two sides of the same fish; origin of dorsal above posterior third of opercle, that of anal approximately beneath eighth dorsal ray, both fins continuous with caudal, which approximately equals head; pectoral small, 1.3 to 1.4 times in head; ventral shorter than pectoral, its slender filamentous tip extending beyond origin of anal. The small firm scales distinct, present also on opercles and preopercles.

The color of fresh specimens is a beautiful reddish, merging into brilliant deep red on dorsal, anal, and caudal, paler on head, belly whitish; a series of yellow or orange crossbands on body, becoming broken into elongate spots anteriorly; head and lateral line with a brilliant silver luster over all; anal and caudal with a black marginal line.

Cantor stated that the caudal rays were black and this statement has been copied by subsequent authors, but I do not find them so.

Alcoholic specimens lose their beautiful markings and ground color, but the silvery luster remains.

Here described from three specimens, 175 to 190 millimeters in length, from Manila Bay; the Bureau of Science collection also contains four specimens, 95 to 130 millimeters in length, likewise from Manila Bay. This handsome fish is occasionally seen in the Manila markets.

It was originally described from Java and the Moluccas and is known from Madras, India, eastward through the East Indies and north to China.

ACANTHOCEPOLA KRUSENSTERNI (Schlegel).

Cepola krusensterni SCHLEGEL, Fauna Japonica, Pisces (1845) 130 (not figure); BLEEKER, Act. Soc. Sci. Indo-Neerl. 3 (1859) Japan, pl. 2, fig. 1.

Acanthocepola krusensterni JORDAN and FOWLER, Proc. U. S. Nat. Mus. 26 (1903) 701; SEALE, Fishes of Hongkong, Philip. Journ. Sci. § D 9 (1914) 69.

Dorsal 92; anal 90–92 in my Philippine specimens; others have dorsal 80–84; anal 78–80; Günther gives dorsal 79–89; anal 76–82; caudal 14; scales in lateral line, 160–170; body covered with firm close cycloid scales, very small anteriorly, about 220 in median longitudinal series.

The depth of the very elongate, compressed, ribbonlike body equals the length of the short blunt head, 8.45 to 10 times in length; eye large, its upper margin coequal with profile, 2.9 to 3 times in head, about 1.5 times the blunt snout; the flat interorbital equals or exceeds snout, 4 to 4.6 times in head; teeth stout, of moderate size, in one row in each jaw; my largest specimen has a double row at tip of lower jaw; maxillary extends to or beyond middle of eye, its posterior expanded portion two-thirds an eye diameter in breadth; lower margin of preopercle with four or five strong spines, the one at angle usually largest, the number often different on the two sides of the same fish; opercle and preopercle with many rows of fine scales.

Dorsal and anal low, continuous with caudal; origin of dorsal above upper angle of gill opening, origin of anal beneath ninth or tenth dorsal ray and about opposite tip of pectoral; the pointed pectoral rather small, about two-thirds as long as head; ventral a trifle shorter, its filiform top not reaching anus.

Color in alcohol yellowish, head and belly silvery; traces of the original beautiful red color are visible on the Manila Bay

specimen; anal and caudal margined by a narrow black line. In life this species is a bright cherry red.

Here described from two specimens, one 212 millimeters long, from Manila Bay, and one 220 millimeters long, in miserable condition, from Puerto Galera, Mindoro. The Bureau of Science collection also contains Seale's specimens from Hongkong.

This handsome species reaches a length of over half a meter. It is common throughout southern Japan and also occurs on the coast of China.

ILLUSTRATION

PLATE 1. *Acanthocepola abbreviata* (Cuvier and Valenciennes). (Drawing by Jose Nievera.)

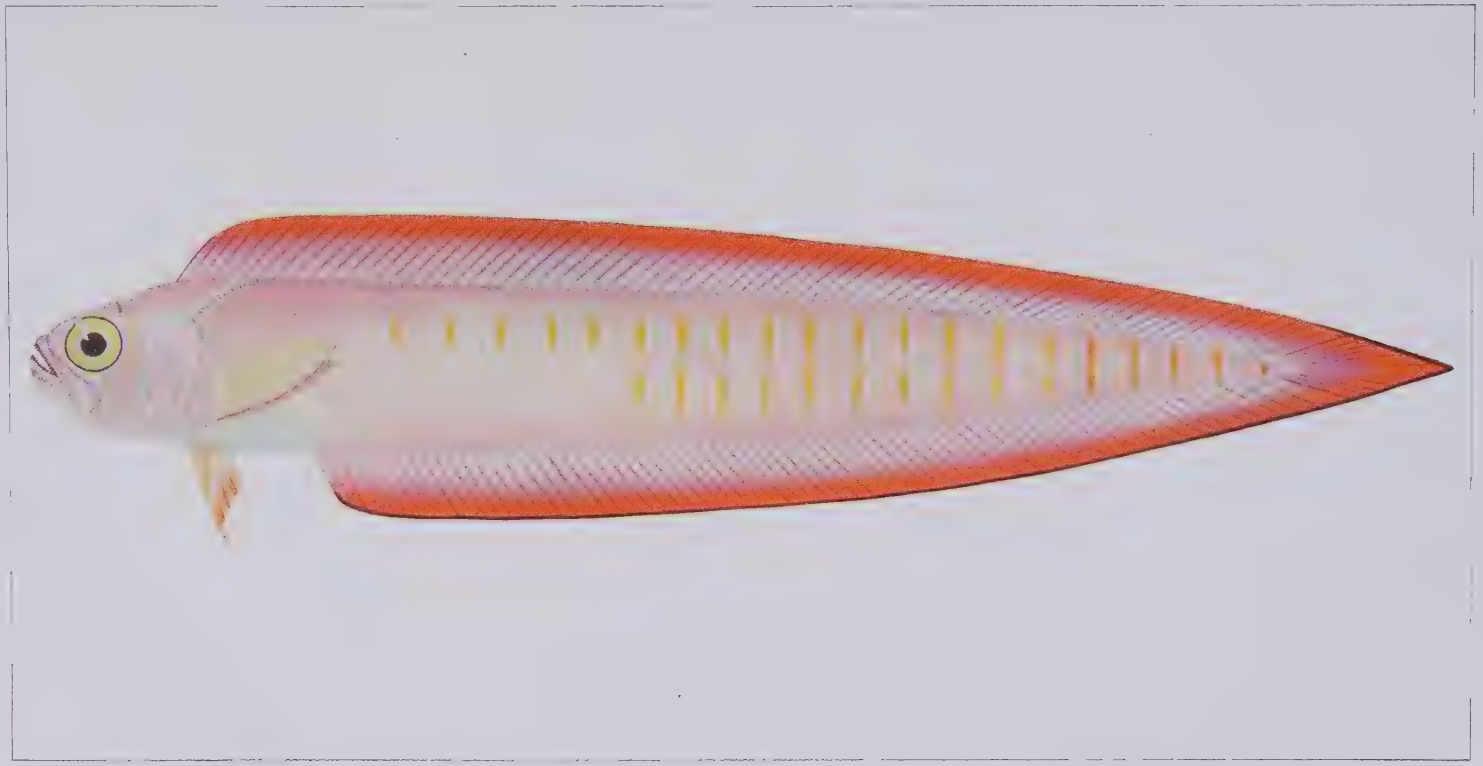

PLATE 1. ACANTHOCEPOLA ABBREVIATA (CUVIER AND VALLENCIENNES).

THE FISHERIES OF LAKE TAAL (BOMBON),[1] LUZON, AND LAKE NAUJAN, MINDORO

By ALBERT W. HERRE

Chief, Division of Fisheries, Bureau of Science, Manila

NINE PLATES

The lakes of the Philippine Islands are of great interest to the geologist and the geographer and often to the seismologist as well. It is the biologist, however, who finds them most fascinating, and it is to the student of fishes and fisheries that they present their most interesting and difficult problems. To some of these lakes belong the most important Philippine freshwater fisheries. Strange to say, in all the lakes anywhere near sea level, except Laguna de Bay, all of the fishes that give them their commercial importance are marine. There has been no biological survey of any of these lakes, but at various times trips have been made to Lake Taal and Lake Naujan by members of the division of fisheries of the Bureau of Science, and the present paper is the record of the observations then made.

Lake Taal is in Batangas Province, Luzon, and lies about 60 kilometers directly south of Manila. It is of volcanic origin and is in large part a crater lake. The earthquake of 1754 enlarged the lake by causing the land to sink where the town of Taal was previously located.

Lake Taal is a sheet of very beautiful, clear blue water, of moderately irregular outline, and contains several islands. Viewed from the summit of the ridge just north of the lake, which forms the watershed between it and Manila Bay, Lake Taal presents one of the most picturesque and attractive views in the Philippines.

Occupying the center of the picture is Volcano Island, with its huge central pit of Taal Volcano and numerous ancient and long-extinct craters. Scattered about it to the northeast are several islets and the high island of Napayan. It is said that the strange abrupt contour of this island is due to a volcanic

[1] Bombon is the Tagalog name of the lake and the name by which it was known to the Spaniards. Taal is the name of the volcano and city.

eruption which blew out part of the floor of the lake and at the same time carried away half of the island. Filling the landscape in the southeast, beyond Lipa Bay, stands the precipitous bulk of an extinct volcano, Mount Macolod. From a distance it seems to rise vertically from the lake itself, but this is not really the case.

The abrupt descent to the lake is seamed and gashed with enormous tortuous gullies of great depth. The lake seems to be surrounded everywhere, except at the northeast, with similar gullied heights, which show the effects of torrential rains.

Lake Taal is somewhat more than 27 kilometers long north and south, and 20 kilometers wide east and west, with a circumference of approximately 120 kilometers.

At Ambulong, at the northeast corner of the lake, the gentle slope of the shore is continued into the water for a considerable distance, and the same thing is true at the outlet of the lake and at a number of other spots along its western coast. In many places, however, the shore rises precipitously from very considerable depths. A few meters from land the depth may be more than 100 meters.

Lake Taal has never been surveyed, but a number of soundings have been made at various points. Lipa Bay, including all the portion between its shore and Volcano Island, is deep. For a long distance its depth averages 95 fathoms, with a maximum sounding of 97 fathoms. As a whole, the lake is very deep. Among the large lakes of the Philippines it is only exceeded in depth by Lake Lanao. In 1909 the level of the lake was 2.54 meters above sea level. Whether it was altered or not by the great eruption of Taal Volcano in 1911 is not known. Volcano Island sank at that time, but to what distance was never determined.

Lake Taal is only about 7 kilometers distant from the sea at the closest point. Its outlet, Pansipit River, is a shallow little stream with gentle sinuosities which increase its length to almost 10 kilometers. In former days Chinese junks or sailing ships freely entered Lake Taal (Bombon) and visited Taal and other centers of population on its shores. Later, when the Spaniards came, their caravels likewise went up to the lake.

With the earthquakes of 1749 and, especially, of 1754 all this changed. Taal was practically demolished, the lake covered part of its site, and a new outlet was created. The present source of the Pansipit is perhaps half a kilometer north of the old outlet. The old valley of the Pansipit lies just southward

of the little barrio of San Nicolas, which is scattered over the hills the base of which the present course of the Pansipit skirts. This new channel joins the old one a kilometer or two down the river valley. Whether the Pansipit became shallower through the silting of its channel or by changes in the elevation of the land I cannot say, but historical evidence indicates that it is unquestionably not so deep as it was in the sixteenth century.

An examination of the animals of Lake Taal reveals a very interesting fish fauna. In it are several kinds of fishes which do not occur in the sea, but in nearly every case they belong to families the members of which are chiefly marine, or else they have the habit of making annual visits to the sea to spawn. Such are the gobies confined to Lake Taal or to other lakes, and described in my book on the gobies of the Philippines and the China Sea.[2] Broadly speaking, its fish fauna, like that of most of the Philippine rivers and lakes, is marine. Medina, who wrote about the lake in 1629–1630, says that Taal (Bombon) was salt. This is hardly likely though it may have been mildly brackish at that time.

All the large fishes of the lake, and all those that make its fisheries of commercial and political importance, are marine. This fact was noted and practical advantage taken of it by keen-eyed and keener-witted men in the dim forgotten past, hundreds and perhaps thousands of years ago.

It is true that some Malays, such as the Hill Dyaks of Borneo, the Bagobos of Mindanao, and the hill tribes of northern Luzon and Formosa, went to the mountains to live permanently; but it is likewise true that by far the greater number of Malays throughout the lands occupied by them lived along water, either fresh or salt. To this the Malays of the Philippine Archipelago were no exception.

It was only natural, therefore, that the shores of Lake Taal (Bombon) should very early have become the dwelling place of a comparatively numerous population, when by far the greater part of Luzon was uninhabited. The towns of Taal, Lipa, and Tanauan were the natural result of the accessibility of the lake to water transportation and the rich lands along much of its southwestern, southern, and eastern shores.

The great depth of the lake and the ease with which its surface is lashed into waves during either monsoon season made it difficult for those early fishermen to get fish from the lake in

[2] Bur. Sci. Monograph 23 (1927).

their crude dug-out canoes. Even to-day the native boats are unable much of the time to navigate the lake but must wait, often for many days, in the shelter of some safe spot. This is because the longest diameter of the lake is northeast and southwest, and the shores are likewise lowest at those corners. This gives the monsoon of either direction full sweep across the lake.

The men of early times observed in the shallow reaches and on the bars of the Pansipit that fish in vast numbers, and often of great size, went from the lake to the sea. This fact once noticed, the rest was easy. The most efficient means of fishing known to the coast-dwelling Malay, and carried by him in all his wanderings, was the *baklad*, or fish corral.

Fish corrals were therefore placed in the upper Pansipit long ago. It can be safely assumed that the baklad of the distant past were small and transitory affairs, which interfered but little with navigation and were of slight consequence during the rainy season. The population was very small, relatively speaking, and the people had no way of preserving or disposing of large quantities of fish. In fact, there was little necessity for so doing, even had it been possible, since a plentiful supply of fish was available at nearly all times.

More centuries went by. The Spaniards came and after the lapse of many decades Roman Catholicism became established. Under the influence of the padres the people were settled in towns, and Taal was founded in 1572. The population increased at a greater ratio than before, under the more stabilized and peaceful conditions and slightly higher standard of living. In 1716 a frightful volcanic eruption on Volcano Island killed vast quantities of fish in the lake. The waves cast these up on the shores in a cooked condition. The same thing happened again in 1731. The lake was soon repopulated with fish by the natural increase of those remaining in it and the uninterrupted migration of others from the sea. In general, it can be said that there was no diminution of fish in the lake or in its outlet, except temporarily, since there was never complete destruction of the spawning stock.

Time went on and there came the great volcanic eruptions and earthquakes of 1749 and 1754. Population had increased in Batangas; but Taal had been destroyed and reëstablished on the rocky hill beside the left bank of the Pansipit where it debouches into Balayan Bay. In its stead only a few score people were living on the hills about the outlet of the lake. In

those days they were practically isolated from the new Taal, 7 kilometers distant by a rude trail over the hills. Lipa, on the eastern shore of the lake, and Tanauan on the northern, had been wrecked, and their discouraged inhabitants removed to the present sites of those towns.

The Pansipit was a shallower stream, at least in part, and it was therefore easier to catch the fish as they took their way to the sea, but the great bulk of the population living about the lake was gone. There was a long period during which but few fish were caught.

During all these centuries there was a vast amount of volcanic activity about the lake, chiefly on Volcano Island. The great central crater, Taal, was a place of intense interest to every intelligent person. For several hundred years it was visited by every traveler or person of note who came to the Philippines, and the records of their impressions and experiences, in Spanish, German, French, and English, are most interesting. Nowhere else could one visit at sea level an obligingly active volcano, guaranteed to give him all the traditional thrills and shocks and usually a few extras not down on the menu.

Slowly the lands about the lake became more densely populated. In time Volcano Island itself, and in fact all tillable land around Lake Taal, became occupied. More than a thousand people were living on Volcano Island when Taal crater blew up in 1911 and destroyed almost the total population.

The pressure of man began to be felt by the fish frequenting the lake. Pansipit River and a goodly portion of Lake Taal (Bombon) belonged to the municipalities of Taal and Lemery. These growing towns, eager for more revenue, always developing more calls for money, put more and more pressure on their fisheries.

Fish, it is self-evident, pay no attention to political boundaries. It should be self-evident that fish, especially the kinds that migrate or move about freely in the water, are the property of the state or the nation. However, in the Philippines, as in Peru and Ecuador, there is a survival of a curious and most pernicious legal custom in certain of the former Spanish colonies. It is perhaps the most ingenious device known to man for ensuring the ultimate complete destruction of the fishery resources of a given region. This evil custom is that of granting to each municipality exclusive control of the fisheries within its bound-

aries. The natural result is that the municipalities tend more and more to deprive the people of their inherent right to catch fish for home consumption from the waters in front of their dwelling, where their forefathers obtained food for untold centuries. Instead, an exclusive franchise is granted to some individual or group of individuals, the franchise usually, if not always, being granted to the highest competitive bidder.

In some instances a monopolistic franchise, extending over a period of several years, seems to have become more or less of a political plum. Whether this is true or not, in all cases it inevitably tends to acquire an altogether fictitious valuation, which compels the successful bidder to pay entirely too much for his fishing privilege.

This is well exemplified in the fishing license for Pansipit River. The present company holding the franchise paid 134,000 pesos for a five-year license. This sum is divided equally between the municipalities of Lemery and Taal, Pansipit River being the boundary between them. The franchise is monopolistic for the river and also carries with it all fishing rights in that part of the lake contained within the limits of the two municipalities.

At every letting of the franchise during the past few periods the successful bidder has had to make a large advance over the previous contract price. The natural result is that huge permanent baklad have been placed in the Pansipit, and that all fish of edible size are caught, none escaping to the sea. These fish corrals completely block the river, leaving absolutely no open runway for the migrating fish. This is a very serious matter, since it ensures the capture of every fish attempting to return to the sea, leaving none for breeding stock. These baklad are so large and well built that they are not affected by storms or floods. The only way in which their successful operation can be affected is for the river to change its course, or for fish to be able to leap clear over one baklad wall after another.

By digging an artificial runway in which the various pens of the baklad are placed, and by barricading the river with woven bamboo, so that all fish are compelled to enter the baklad, the licensees have averted all difficulties that might ensue were the river to alter its channel. The only fish able to leap over the high walls of the baklad are the meter-long bañgos, which can hurl themselves in the air to an astonishing height. They

well deserve their local name of *lumulukso,* the Tagalog word for leaping; but even the agile and athletic lumulukso are rarely able to leap out to safety. The views presented (Plates 3 and 4) show that one pen leads into another, so that when a fish does leap a wall it usually has merely jumped from one inclosure into another.

Naturally the company cannot afford to introduce any conservation methods, since to do so would invite bankruptcy. Before it can earn a profit it must get back the enormous cost of its franchise.

An inevitable result is high prices for fish. When only a moderate amount of fish is being caught the cost at the corral is greater than the price at which the same kind of fish can be purchased in Manila. The company is able to sell most of its catch at very high prices because of the large population in the towns of Lemery and Taal and their numerous barrios, and all along the highway clear to the town of Batangas. The increased truck transportation makes feasible the distribution of fish over a great area, in spite of the fact that as yet most of the catch must be taken to Taal on horseback. When the catch is heavy, fish are taken across the lake to Talisay, loaded on autotrucks, and shipped to Manila. It is easy to see that not only the local increase in population, but also, to a much greater degree, the improvement in transportation bears heavily on the fishes of Lake Taal.

During the late spring and summer months the fry of various marine fishes make their way up the Pansipit and enter Lake Taal. Here they remain for longer or shorter periods of time, depending upon the species. Some kinds stay one, two, three, or more years. One kind of pampano, or *Caranx,* returns at all times to the sea, never remaining until mature, most of the fishes of this genus leaving when about a year old. Bangos, snappers, and one species of pampano, or *Caranx,* remain until they are fully grown and nearly or completely mature sexually. Then they start for the sea with a rush, since nature is calling them to spawn. Under present conditions none of them ever get there.

People living about the lake complain that the largest and finest-flavored fishes are much rarer now than they were formerly, forty or fifty years ago. It is apparently true that the total number of fish caught at or near the outlet of Lake Taal is as large as ever, and their value is certainly greater

than it was formerly. The company holding the franchise is able to catch as many fish as previously by making its baklad larger, tighter, and stronger, so as to catch them all. It is apparently true that there has been a falling off in the catch of the two most valuable kinds, lumulukso and *maliputo*.

The most important of the Lake Taal fishes are various species of Carangidæ, of which *Caranx marginatus* Gill, known as *muslo* locally, is caught in by far the largest quantity. Most muslo leave the lake when they are about a year old, and are not more than half their sexually mature size; many leave much earlier, even when only about 75 millimeters long, and mature muslo are not found in the lake.

Caranx ignobilis (Forskål), known locally as *maliputo*, remains in the lake until it is very much larger, and ready or nearly ready to spawn. It is probably then about three years old. This fish is very highly esteemed, and fetches the highest price.

The fishermen distinguish seven kinds of Carangidæ, but they apply different names to the same fish at various stages of its growth. So far we know definitely of but two species of *Caranx* living in the lake, though it is possible that three may be present.

The fry of bañgos (*Chanos chanos*) remain in the lake until they are at least three or four years old and have reached a length of a meter or more. These large bañgos are called lumulukso, a Tagalog word meaning leaping, because of their astonishing saltatorial powers. Lumulukso are of exceedingly delicious flavor and are comparatively free of the excessively numerous fine bones that are so pestiferous in the young bañgos grown in the fishponds about Manila Bay.

Another valuable fish, which reaches a length of two-thirds of a meter or more and a weight of several kilograms, is the *alsó*. It is a gray snapper belonging to the Lutianidæ, and very close to, if not identical with, *Lutianus argentimaculatus*. One of the red snappers also occurs in the lake, and is occasionally caught with hook and line.

During the height of the rainy season large numbers of *banak*, *Liza melinopterus* (Cuvier and Valenciennes) and *Liza troscheli* (Bleeker), enter the river on their way to the sea to spawn. It is at this time, too, that most freshwater eels, or *igat*, *Anguilla mauritiana*, endeavor to return to their remote and mysterious spawning ground. Some of the eels caught are very large. *Kitang*, *Scatophagus argus* (Gmelin), is another good food fish

caught in quantity at times. Hundreds of *buan buan, Megalops cyprinoides* (Broussonet), enter the corral at this time also. Buan buan is a large silvery fish, thin and bony, and of indifferent quality.

In addition to the baklad in Pansipit River, the company operates several other large baklad in the lake itself. These are all located along the southeastern coast, not a great distance from Pansipit River, in water 8 to 12 meters deep, and catch chiefly *malipito* and lumulukso on their way to the outlet of the lake.

Thirteen kinds of gobies are known to occur in Lake Taal. One of them, *biang puti, Glossogobius giurus* (Buchanan Hamilton), is an important food fish to the villagers living about the lake; it is mainly caught by hook and line. Four other kinds of gobies are also large enough or numerous enough to be used commonly as food. They are *Glossogobius celebius* (Cuvier and Valenciennes), *Ophiocara aporos* Bleeker, *Chonophorus melanocephalus* (Bleeker), and *Aparrius acutipinnis* (Cuvier and Valenciennes).

As stated previously, no extended survey has ever been made of the fish living in Lake Taal. Of those thus far known, by far the great majority are migratory. In all other large Philippine lakes *dalag, Ophicephalus striatus* Bloch, is one of the most important fishes, and is caught and marketed in large numbers. *Hito, Clarias batrachus* (Bloch), is also locally important when it occurs in lakes. Although both these fishes occur in Lake Taal, neither of them is of much importance; unquestionably conditions in the lake are not very favorable for them, or they would be more abundant. They swarm in the small streams flowing into the lake, and in the few ponds near it. It is also a singular fact that no catfishes of the family Ariidæ are found in Lake Taal, although they are the commonest fish in Laguna de Bay and occur in large numbers in both fresh and salt water in most parts of the Philippines.

Strange to say, the most important permanent resident of the lake is a sardine, *Harengula tawilis* Herre, which does not occur outside of Lake Taal, so far as known. This thin, hard-scaled, silvery sardine, called *tawilis* by the people about the lake, is not of high quality. It occurs in schools and is caught mainly by gill nets. The fishermen cruise about in their small sailing bancas, or dug-out canoes, until a school is found; then they place their nets and at times make large catches. Fre-

quently they set their gill nets so that these float some distance below the surface, and lift them the next morning. These sardines are mostly eaten fresh or dried; sometimes they are cooked in vinegar, wrapped in banana leaves, and sent to the interior towns of Batangas Province and to the towns along Laguna de Bay. In Morga's Sucesos, written in 1609, he states that the "Indians living on the shores of Bombon preferred this sardine to larger fish. They cooked it in many ways and also dried and cured large quantities."

It is a very interesting fact that sharks are permanent residents in the lake and never attempt to migrate to the sea. This is shown by the fact that they are never caught in the baklad blocking the river. I have been unable to obtain any specimens as yet, and cannot tell whether they breed in the lake or not.

Another resident of the lake of much interest, even though it is not a fish, is one of the banded sea snakes, *Disteira cyanocincta* (Daudin). It is common in Lake Taal, but does not enter any of the other large Philippine fresh-water lakes near sea level.

The following list of species in Lake Taal is by no means complete, but it contains those thus far known to occur there; species positively known to return to the sea to breed are indicated by the letter *M:*

1. *Carcharhinus* sp.
2. *Megalops cyprinoides* (Broussonet); *M.*
3. *Chanos chanos* (Forskål); *M.*
4. *Harengula tawilis* Herre.
5. *Anguilla mauritiana* Bennett; *M.*
6. *Clarias batrachus* (Bloch).
7. *Hemirhamphus quoyi* Cuvier and Valenciennes; *M.*
8. *Zenarchopterus dispar* (Cuvier and Valenciennes).
9. *Hepsettia balabacensis* (Seale); *M.*
10. *Liza melinopterus* (Cuvier and Valenciennes); *M.*
11. *Liza troscheli* (Bleeker); *M.*
12. *Bombonia luzonica* Herre.
13. *Caranx ignobilis* (Forskål); *M.*
14. *Caranx marginatus* Gill; *M.*
15. *Leiognathus caballus* (Cuvier and Valenciennes); *M.*
16. *Amia hyalosoma* Bleeker; *M.*
17. *Mionurus bombonensis* Herre.
18. *Ambassis batjanensis* Bleeker; *M.*
19. *Ambassis urotaenia* Bleeker; *M.*
20. *Priopis buruensis* (Bleeker); *M.*
21. *Priopis gymnocephalus* (Lacépède); *M.*
22. *Kuhlia marginata* (Cuvier and Valenciennes).

23. *Kuhlia rupestris* (Lacépède).
24. *Lutianus argentimaculatus* (Forskål); *M.*
25. *Lutianus* sp.; *M.*
26. *Therapon jarbua* (Forskål); *M.*
27. *Theraponidæ* sp.; *M.*
28. *Gerres punctatus* Cuvier and Valenciennes; *M.*
29. *Sillago sihama* (Forskål); *M.*
30. *Ophicephalus striatus* Bloch.
31. *Pomacentrus tripunctatus* Cuvier and Valenciennes; a ripe female; *M.*
32. *Toxotes jaculatrix* (Pallas); breeds in the lake.
33. *Scatophagus argus* (Gmelin); *M.*
34. *Hypseleotris modestus* (Bleeker).
35. *Ophiocara aporos* Bleeker; *M.*
36. *Gnatholepis volcanus* Herre.
37. *Vaimosa macrognathus* Herre.
38. *Vaimosa piapensis* Herre.
39. *Glossogobius biocellatus* (Cuvier and Valenciennes); *M.*
40. *Glossogobius celebius* (Cuvier and Valenciennes); *M.*
41. *Glossogobius giurus* (Buchanan Hamilton); *M.*
42. *Rhinogobius flavoventris* Herre.
43. *Aparrius acutipinnis* (Cuvier and Valenciennes); *M.*
44. *Chonophorus melanocephalus* (Bleeker); *M.*
45. *Chonophorus ocellaris* (Broussonet); *M.*
46. *Taenioides caeculus* (Bloch and Schneider); *M.*
47. *Petroscirtes ferox* Herre.

There can be no question that the migratory fishes of Lake Taal are being overexploited at the present time. A free runway should be left permanently open in the river, for at least one-fourth of its width. This would give mature fish an opportunity to return to the sea to spawn, thus keeping up the supply of fry to restock the lake. The present method of killing off all breeding stock is slowly but surely destroying the chief food fishes of Lake Taal.

LAKE NAUJAN

Lake Naujan is a large lake in northeastern Mindoro, occupying a portion of the extensive plain lying at the eastern foot of the great central mountain mass of the island. This plain extends from Calapan to Bongabon but is separated from the coast much of the way by high rugged rocky hills.

The lake is not correctly shown on any published map, and apparently has never been surveyed. It is approximately 16 kilometers long by 9 kilometers or more in breadth, of fairly regular outline, with two small islands very close to its eastern bank.

The town of Pola, at the head of Pola Bay east of the central part of Lake Naujan, is only about 5 kilometers away in a straight line. This is the nearest coastal point to the lake, but the intervening range of rugged hills or mountains makes approach from that side difficult. At the northeastern corner of the lake is its outlet, a narrow and very crooked creek about 20 kilometers long, which reaches the sea at the barrio of Lumangbayan. This was the original site of the town of Naujan, which was abandoned about sixty-five years ago because of repeated raids by Moro pirates. The creek is navigable for good-sized launches, although at low tide a bar at its mouth is impassable for anything except small bancas.

To the west Lake Naujan is half encircled by lofty and very rugged mountains, and from its surface one has a most inspiring view of Mount Halcon. The eastern shore of the lake is very bold and rugged, but everywhere else it is bordered by extensive swamps and wide marshes, lake and land passing from one to the other imperceptibly. Beyond the swamps are heavy forests, infested with land leeches. On the mud flats rising a few inches above water are swarms of ducks, white egrets, and sandpipers, while everywhere in the luxuriant lotus and *talahib* growth are rails and grebes. In the lake itself are seen on every hand weird snakebirds.

Crocodiles are very abundant in Lake Naujan, and they evidently find conditions ideal there. The Dominican Navarrete, writing about the year 1650, tells of them snatching people from bancas, and carrying off others when bathing. At the present time they apparently do not attack people. They can be seen at any time on a trip across the lake, and one can usually count from three to half a dozen in sight, their black heads or even their whole form just afloat and looking like floating logs or half-submerged chunks of wood. I have had one between 3 and 4 meters in length come up within 1.5 meters of my boat.

Sharks are more numerous here than in Lake Taal, and specimens 3 or 4 meters in length are caught occasionally by hook and line. *Carcharhinus gangeticus* Müller and Henle, the dreaded man-eating shark of the Hoogly at Calcutta, is the only species known from Lake Naujan.

Tagan, or sawfish, occur in Lake Naujan and are caught at rare intervals at the Butas fish corral. They reach a length of 5 meters.

The fish fauna of Lake Naujan is very similar to that of Lake Taal, but the former lake is far shallower and, as already stated, its borders for long distances are merely swamp. Accordingly there are a few striking differences in the fish faunas of the two lakes. Nowhere does Lake Naujan have any such great depth as occurs in Lake Taal. Over large areas Lake Naujan is only 3 or 4 meters deep, and over still larger areas it is less than 10 or 12 meters deep. It is therefore far richer in plant life, and the water is dense with vegetation for long distances, whereas in Lake Taal the water is generally far too deep for plants to grow from the bottom. Conditions in Lake Naujan are therefore exceedingly favorable for mullet, or *banak*, and consequently for large fishes which prey upon these.

Lake Naujan is deepest in its southern third, where we found depths of 30 to 40 meters a kilometer from the shore.

Lake Naujan has long been noted for its fishes. Navarrete said that the lake was full of fish, especially skates. Sometimes people were able to catch them with their hands; then they would take out the eggs and let the fish go. The eggs when salted were considered a great delicacy and were very much prized when eaten with rice. At the present time skates are apparently unknown from Lake Naujan.

Two fishes of insignificant size and of little value for human food are nevertheless of great importance in maintaining more important fishes. *Pait* is the name applied to a small cyprinid fish which ocurs in great abundance in Lake Naujan and in all the streams tributary to it, as well as throughout northeastern Mindoro. It reaches a length of 75 to 100 millimeters, but, as its name pait indicates, the flesh is bitter and not usually eaten by human beings. This is no drawback to carnivorous fishes and pait forms one of the main articles of diet for the fishes sought by man.

Lañgaray is the Tagalog name for the species of Ambassidæ, small and very bony, semitransparent, silvery little fishes, which occur in incredible swarms in the rivers at certain times. Lake Naujan teems with lañgaray and they are apparently the chief food of the singular snakebirds. Lañgaray are so well armed with dorsal and anal spines that they are safe from small or medium-sized fishes; but large snappers, pampano, dalag, buan-buan, and other large-mouthed carnivorous fishes of 300 or more millimeters in length devour them greedily.

Catfishes of the family Ariidæ seem to be absent from the lake and its outlet, as in Lake Taal and the Pansipit. Conditions would seem to be ideal in Lake Naujan for *kanduli*, so that their absence is puzzling. A still stranger thing, and one which I can hardly believe, is the apparent absence of halfbeaks, family Hemiramphidæ; yet the fishermen assure me there are absolutely none in the lake and its outlet. Halfbeaks are typical of rivers and lakes at low levels in the Philippines, so that their absence from Naujan is one I cannot understand.

At the sitio of Butas, about halfway between the lake and the sea, a baklad has been located for a long time. In former years baklad were erected at other points along the river, but now the municipality grants an exclusive franchise to the highest bidder. He not only secures the privilege of placing a baklad at Butas, but his franchise gives him the fishing rights to the whole river, and for a certain distance into the lake itself.

The Butas baklad is far smaller and cheaper than either of the two operated in Pansipit River, and the methods followed are not so rigorous. Then, too, it is more loosely woven, so that small fish returning to the sea can readily pass through it. The baklad does not occupy the whole river, but extends about three-fourths of the way across. The remaining portion is barred by a dam which does not reach to the surface, but can be crossed by a banca or small launch. Palm leaves are laid across the clear space, and their motion in the current frightens most fish so that they do not attempt a passage. However, snappers and bañgos often leap the slight barrier and thus escape.

The baklad has a wide mouth, facing upstream, of course. This is closed by a net, as shown in Plate 6, fig. 2, whenever the watchers see a sufficient number of fish enter the baklad.

At a shallow place a couple of hundred meters below the baklad the men of the neighborhood have erected bamboo stands, as shown in Plate 7. From these stands they can observe the passing of schools of lañgaray, *Ambassis urotaenia* Bleeker, and they catch these by throwing the *dala*, or casting net. For the privilege of fishing they pay the licensee two-thirds of their catch.

The present holder of the license pays 20,000 pesos for a four-year license. The successful bidder is allowed to pay his license fee quarterly, so that all he need pay down in advance

is 1,250 pesos for the first quarter. The baklad costs about 500 pesos, and the total initial expense, including nets and baklad material, does not amount to more than 2,000 pesos. The receipts from the baklad soon repay the first cost and provide a handsome surplus.

The municipal council of Naujan has passed an ordinance requiring the licensee to allow all mullet, or banak, to escape during the period from January 15 to February 15, inclusive. The value of this conservation method is not yet really known, but it is at least a step in the right direction.

The people living around the lake are allowed to fish in it for home consumption only, but there is talk of depriving them of this natural right. Until a few years ago there were no permanent settlements around the lake or along the upper part of the river. Only a few Mangyans lived at times on the shores of Lake Naujan. As late as 1910 there were no more people making their homes beside the lake than in Navarrete's time, two hundred sixty years earlier. Within the past two years over two hundred Ilocano homesteaders have settled on the southwestern shore of the lake, and there are many families now living between Butas and the lake. In a few years more forest and swamp will be cleared, timarao, land leeches, and water fowl will disappear, and autotrucks will be serving a heavy population about the lake and plying between Calapan and Pinamalayan.

The most important fish to the Mangyans and Ilocanos about the lake is dalag. This fish abounds in Lake Naujan and is the principal food fish actually caught in the lake. Most of the dalag are caught with hook and line. First a goby, *Ophiocara aporos* Bleeker, locally known as *palawan,* is caught in a *bobo,* or bamboo trap and is then used for bait. Dalag are caught with pole and line, or more often by attaching long lines, known as "trot-lines" in the Mississippi Valley, to poles erected in the lake. Each long line carries many short lines, a meter or two apart.

The most highly esteemed fish caught in the Butas baklad is *simbad, Caranx marginatus* Gill; this fish, which is the same as the muslo of Lake Taal, returns to the sea at all times of the year and does not remain in fresh water for any fixed period, but the average size of the muslo is greater than that of those of Lake Taal. They usually measure about 250 millimeters in length. Larger ones, distinguished under the name *pinkit,* from

350 millimeters to 0.5 meter in length, are also frequently taken. It is not unusual to take 200 or 300 simbad a day, averaging nearly a kilogram each. The people claim that the simbad taken on their way to salt water, after having lived in Lake Naujan, have a much finer flavor than those taken from the sea.

The largest fish migrating from the lake to the sea are the gray snapper, or alsó, *Lutianus argentimaculatus*. It frequently remains in the lake until mature and then, in the rainy season, starts to the sea to spawn. One or two hundred, averaging 4 to 6 kilograms in weight, may be taken in a single day. Sometimes they are nearly a meter long, and weigh 10 to 12 kilograms. This fish is often caught by hook and line in the lake.

Bañgos, called *bañglis* here, occur as in Lake Taal, running down the river in the spring months, but never in very large numbers. Two or three dozen meter-long fish are a good day's catch, and usually only a few are taken. Owing to their marvelous leaping ability some escape, the Butas baklad being much smaller and lower than those in Pansipit River.

The most abundant fish in the lake, and the one caught in largest quantity at Butas, is a mullet, *Liza troscheli* (Bleeker). Unquestionably several other species of mullet occur in the lake, but I have seen only a few specimens of *Mugil dussumieri*. November to February are the months of the big mullet runs. Their gonads become enormously distended while still in the lake, so that they go with a rush when they finally start to the sea to spawn. In November and December they come down the little river in great schools. Five, ten, even fifteen thousand banak have been caught in a single day in the Butas baklad. The number coming down the river in January and February is very much smaller; but, if the ordinance allowing mullet to pass during those months is well enforced, it will help amazingly in keeping up the run. Large schools of mullet, of various sizes, can be seen in Lake Naujan, but they are seldom taken. Sometimes they are caught with gill nets, but crocodiles and sharks are too apt to play havoc with the net.

Many other kinds of fish are taken at the Butas baklad, but the commercial catch is largely confined to gray snapper, mullet, bañgos, and pampano, or simbad. Other fishes caught in greater or lesser quantity and readily salable are *managat*, or red snapper, *kitang, lumas, damagan, apahap, buan-buan, asohos*, and *bagaoñg*.

The following list of fishes thus far known from the lake is a very incomplete one. It is hoped that during the next year additional specimens may be obtained of the snappers and mullet living in the lake, as well as a representative collection of the small species occurring there. Those known to return to the sea are marked *M* in the list, and the native name is given for most of them.

1. *Carcharhinus gangeticus* Müller and Henle; *M.* Pating.
2. *Pristis microdon* Latham; *M.* Tagan.
3. *Megalops cyprinoides* (Broussonet); *M.* Buan-buan.
4. *Chanos chanos* (Forskål); *M.* Bañglis.
5. *Anguilla mauritiana* Bennett; *M.* Igat.
6. *Barbodes hemictenus* Jordan and Richardson. Pait.
7. *Clarias batrachus* (Bloch). Hito.
8. *Mugil dussumieri* Cuvier and Valenciennes; *M.*
9. *Liza troscheli* (Bleeker); *M.* Banak; when very large, aguas.
10. *Caranx marginatus* Gill; *M.* Simbad when small or medium size; pinkit when large.
11. *Leiognathus caballus* (Cuvier and Valenciennes); *M.* Malaway.
12. *Amia hyalosoma* Bleeker; *M.*
13. *Ambassis batjanensis* Bleeker; *M.* Lañgaray.
14. *Ambassis urotaenia* Bleeker; *M.* Lañgaray.
15. *Kuhlia marginata* (Cuvier and Valenciennes).
16. *Kuhlia rupestris* (Lacépède). Damagan.
17. *Lates calcarifer* (Bloch); *M.* Apahap.
18. *Cromileptes altivelis* (Cuvier and Valenciennes); *M.* Apahap.
19. *Lutianus argentimaculatus* (Forskål); *M.* Alsó.
20. *Lutianus* sp.; *M.* Managat.
21. *Therapon jarbua* Forskål; *M.* To-tot.
22. *Therapon cancellatus* Cuvier and Valenciennes; *M.* Bagaoñg.
23. *Gerres punctatus* (Cuvier and Valenciennes); *M.* Lamas.
24. *Sillago sihama* (Forskål); *M.* Asohos.
25. *Ophicephalus striatus* Bloch. Dalag.
26. *Anabas testudineus* (Bloch). Puyo.
27. *Toxotes jaculatrix* (Pallas). Kataba.
28. *Scatophagus argus* (Gmelin); *M.* Kitang.
29. *Hypseleotris modestus* (Bleeker).
30. *Belobranchus belobrancha* Cuvier and Valenciennes; in Malayas River near the lake.
31. *Vaimosa macrognathus* Herre.
32. *Ophiocara aporos* Bleeker. Palawan.
33. *Glossogobius giurus* (Buchanan Hamilton); *M.* Bia; dapal.
34. *Glossogobius celebius* Cuvier and Valenciennes; *M.*
35. *Chonophorus melanocephalus* (Bleeker); *M.* To-od.
36. *Chonophorus ocellaris* (Broussonet); *M.* To-od.
37. *Taenioides cirratus* (Blyth); *M.*

ILLUSTRATIONS

PLATE 1

FIG. 1. A trading and freight boat on Lake Taal; Volcano Island in the background.
2. Looking up Pansipit River. The weir at the left completely blocks the channel and forces all fish into the baklad.

PLATE 2

FIG. 1. Part of Lake Taal at the source of Pansipit River.
2. Bamboo being prepared for use in the baklad. This is on the wide flat at the source of Pansipit River.
3. Looking up Pansipit River, showing both sides of the river.

PLATE 3

FIG. 1. A bamboo raft, used for catching large bañgos or lumulukso. When they leap to escape they strike the wall, fall on the wide platform, and are then picked up.
2. A view of the main part of the baklad.

PLATE 4

FIG. 1. Inside the baklad, looking downstream toward the runway. Note the bamboo raft at the left; this is the one shown in Plate 3, fig. 1.
2. Small inclosures beside the cottage. Here fish are kept on hand, ready for buyers.
3. Inside the baklad "heart," looking toward the lake; Volcano Island in the distance. The central part is the runway leading into the "heart" of the baklad.

PLATE 5

FIG. 1. Cottage and inner compartment of the Pansipit baklad.
2. A mullet, or banak, caught in the Pansipit baklad on its way to the sea to spawn.

PLATE 6

FIG. 1. A general view of the Butas baklad, Naujan River, Mindoro.
2. Looking upstream from the baklad. The net is used to close the mouth when a school of fish enters.

PLATE 7

FIGS. 1 and 2. Catching lañgaray in Naujan River. The men watch for a school of fish, then throw over it their dala, or casting net.

PLATE 8

FIGS. 1 and 2. Looking downstream at the closed end of the Naujan River baklad.

PLATE 9

FIG. 1. Naujan River baklad. Looking upstream at a small "heart" built at the upper extremity of the side wall of the baklad. The net used for closing the baklad entrance is at the left.

2. An Iloxano homesteader at Malayas, Lake Naujan. The little girls are Mangyans, attending the Malayas farm school.

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PLATE 1

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PLATE 2.

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PLATE 3.

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PLATE 4.

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PLATE 5.

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PLATE 6.

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PLATE 7.

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PLATE 8.

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PLATE 9.

TINGITIDÆ FROM THE FAR EAST AND MADAGASCAR (HEMIPTERA)

By CARL J. DRAKE

Of the Iowa State College, Ames

Genus ABDASTARTUS Distant

Antennæ very long, slender; segments III and IV very long and slender. Antenniferous tubercles prominent, spinelike. Pronotum and head raised anteriorly, suberect. Legs long and slender. Orifice distinct, prominent. Bucculæ closed in front. Rostral canal open behind. Type of genus, *Abdastartus tyrianus* Distant.

ABDASTARTUS TYRIANUS Distant.

Several specimens: Randoeblatoeng, Java, July 7, 1923, collected on sugar cane; and Formosa. Heretofore recorded by Distant from Bengal and Pusa. The antennæ and legs are shorter in the female than in the male.

ABDASTARTUS MUIRI sp. nov.

Very much smaller than *A. tyrianus* Distant. Head chestnut brown; posterior spines long, stout, blunt, curved, contiguous with dorsal surface of head, directed forward; anterolateral spines short, tuberclelike; median spine wanting. Antenniferous tubercles short, blunt, curved inwardly. Antennæ long, slender, brown; segment I a little longer and slightly stouter than II; IV fusiform; proportional lengths: I = 9, II = 12, III = 62, IV = 22. Bucculæ very broad, closed in front, rostrum reaching metasternum. Coxæ widely separated. Pronotum deeply pitted, transversely swollen through the disk, brown, the carinæ, paranota, and anterior margin pale testaceous. Paranota narrow, uniseriate, collum very distinct, broad, the anterior row of cells pale testaceous. Carinæ prominent, each composed of a single row of minute cells, the lateral carinæ slightly divaricating in front.

Elytra brownish testaceous, areolæ evenly arranged, the areas bounded by prominent nervures; costal area narrow, uniseriate, testaceous, the cells translucent; subcostal area biseriate; dis-

coidal area impressed, reaching slightly beyond middle of elytra, with four rows of cells at its widest part. Wings considerably longer than abdomen, but shorter than elytra. Body beneath dark reddish brown. Metasternal orifice prominent. Legs long, slender, brown. Length, 2.14 millimeters; width, 0.5.

Holotype (male) and allotype (female), Pekalongan, Java, May, 1907, F. Muir, collector, in Drake collection. Paratype (male), Singapore, India, in Baker collection. The much smaller size and concolorous costal area readily separate this species from *A. tyrianus* Distant.

TRACHYPEPLUS BAKERI sp. nov.

Ovate, brownish testaceous, marked with dark brown to fuscous; head and pronotum chestnut brown, with the prominent white exudations. Bucculæ broad, reticulate, closed in front. Rostral channel widening posteriorly; rostrum reaching to intermediate coxæ. Eyes blackish. Antennæ moderately long; segment I a little stouter and slightly longer than II; II obconical, brown; III testaceous, very slender, a little more than twice the length of IV; IV brown, much longer than I and II taken together, fusiform, considerably stouter than III, clothed with moderately long hairs. Head short, with five spines; each spine stout, moderately long, blunt, semierect, testaceous, embrowned at tip. Antenniferous tubercles spinelike, testaceous, bent obliquely downward and contiguous with head. Pronotum moderately narrowed anteriorly, broad in front, strongly and transversely swollen through the disk, coarsely punctate, clothed with numerous, short, scalelike hairs, tricarinate. Paranota reflexed back against pronotum, with three to four rows of areolæ, armed with a few sharp spines along the sides. Carinæ distinct, parallel, nonreticulate. Median portion of pronotum strongly raised anteriorly, forming a rooflike hood, projecting triangularly in front.

Elytra broadly rounded behind, the lateral margins armed with sharp slender spines, sparsely clothed with short yellowish scalelike hairs, testaceous; a broad transverse band near apex, a broad fascia at middle of costal area, most of the nervures of sutural area and a rather broad and somewhat circular ringlike area near the middle of each elytron brown to fuscous; areolæ translucent. Costal area mostly quadriseriate, the areolæ not arranged in very regular rows; subcostal area mostly biseriate, triseriate at the widest part; discoidal area broad, with eight

rows of cells at the middle, narrowed at the base and apex. Length, 2.5 millimeters; width, 1.41.

Holotype (male), Iligan, Mindanao, Philippine Islands, collected by C. F. Baker, in Drake collection. Allotype (female), taken with holotype, in Baker collection. This species may be distinguished from *T. jacobsoni* Horvath by the broad costal area.

ELASMOGNATHUS HELFNERI Fieber.

One specimen, female, Mount Maquiling, Luzon, Philippine Islands, C. F. Baker, collector. The bucculæ are closed in front and the metasternal orifice is distinct.

ELASMOGNATHUS INUSITATUS sp. nov.

Elongate, widening posteriorly. General color black; hood brownish; costal area brownish testaceous, the prominent transverse nervures and a broad band near the middle black; areolæ along distal margin of elytra brownish testaceous. Legs brown, the tarsi and apices of tibiæ black.

In form and general color very similar to *E. greeni* Kirby, but larger and longer; antennæ and legs also longer. Antennæ brown, the distal segments black; segment I brown, thicker and nearly twice as long as II; III very long, slightly curved, more than two and a half times as long as IV; IV slightly enlarged, clothed with numerous short hairs, brown at base. Paranota formed somewhat as in *E. nepalensis*, but larger at base and more distinctly constricted below the knob. Hood larger and higher than in *greeni*, somewhat cone-shaped. Median and lateral carinæ a little larger than in *greeni*. Apex of pronotum black. Elytra a little broader and longer than in *greeni;* costal area slightly broader and the transverse band a little narrower; subcostal area broader, biseriate, the areolæ larger. Hood and spines as in *greeni*. Bucculæ closed in front. Rostral channel gradually widening posteriorly, open behind, the rostrum reaching between intermediate legs. Wings a little shorter than abdomen. Body beneath black. Length, 6.5 millimeters; width, 2.1.

Holotype, male, Mount Maquiling, Luzon, Philippine Islands, collected by C. F. Baker; in Drake collection.

HARMIDAS DIVERSATIS sp. nov.

Moderately large, elongate, testaceous, with brown or black markings. Pronotum, head, and body beneath clothed with white recurved hair. Legs moderately long, slender, pale testaceous.

Rostrum reaching almost to intermediate coxæ. Bucculæ closed in front. Head brown, with five long slender spines, the posterior pair a little longer than the others. Antenniferous tubercles spinelike, not quite reaching tip of first antennal segment. First and second segments of antennæ moderately stout, brown, the third and fourth segments wanting.

Nervures of paranota, carinæ, and elytra clothed with numerous, moderately long, yellowish hairs, the tips of which are slightly recurved. Paranota narrow, uniseriate, composed of five moderately large cells. Pronotum slightly swollen through disk; carinæ foliaceous, each composed of a single row of moderately large cells. Collum and median carina jointly raised in front. Areolæ of elytra, carinæ, and paranota whitish, opaque, costal area uniseriate; subcostal area mostly uniseriate; discoidal area impressed, long, narrow, triseriate at the widest part. Length, 2.16 millimeters; width, 0.91.

Holotype (female), Madagascar, in Drake collection. Differs from *H. vicarius* Drake and *H. pictus* Distant in having the paranota and costal area uniseriate. The outer nervure of paranota does not terminate in a spine anteriorly. The apex of discoidal area and the nervure between subcostal and discoidal areas are raised as in *H. pictus* Distant.

XENOTINGIS TREPIDANTIS sp. nov.

Elongate, slightly widening posteriorly. Head brown; spines brownish testaceous, moderately long, stout, blunt, directed downward. Antennæ long, moderately slender, brown; segment I a little stouter and longer than II; III very long, slenderest, slightly curved, twice as long as I and II taken together. Bucculæ broad, closed in front. Rostral channel wide; laminæ broad; rostrum reaching to the middle of the first abdominal segment. Antenniferous tubercles broad, laminalike, broadly rounded in front, prominent. Odiferous canal very long, prominent. Legs moderately long, brown.

Paranota extremely large, semiglobose, projecting over the pronotum, the areolæ large. Pronotum brown, long, tricarinate, with median and triangular portions exposed. Hood covering base of head, somewhat cone-shaped, the median carina strongly raised anteriorly, uniting with the crest of the hood. Lateral carinæ foliaceous, areolate, constricted near the middle, exposed behind; the paranota projecting above and covering the greater portion of them. Elytra slightly widening posteriorly,

rounded behind, brown, with testaceous markings; costal area broad, the outer margin recurved (rolled) on the basal half, triseriate at the base, apical half biseriate and testaceous; subcostal area mostly triseriate; discoidal area very distinct, extending a little beyond the middle of the elytra, widest at middle, with five rows of cells at widest part. Areolæ on distal half of elytra somewhat clouded with fuscous. Areolæ of paranota large, not transparent; wings longer than abdomen, but much shorter than elytra. Length, 4.42 millimeters; width, 2.1.

Holotype (female) Madagascar, in Drake collection. Paratype (female), taken with type. The stronger antennæ and legs, shape of paranota, and distinctly larger nervures separate this species from its congeners. The margins of the paranota leave a long rectangular space (median portion) of the pronotum exposed between them. The areolæ of sutural, discoidal, and basal half of costal areas are opaque.

SERENTHIA VICINALIS sp. nov.

Elongate, narrow, pale testaceous, the head and pronotum (collum and triangular process testaceous) dark reddish fuscous to black. Antennæ and legs brownish testaceous. Legs short. Antennæ moderately long, rather stout; segment I slightly thicker and subequal in length to II; III not very slender, three times the length of II; IV nearly one and a half times the length of II, fusiform, clothed with a few long hairs. Antenniferous tubercles prominent, blunt, brownish. Bucculæ broad, closed in front; rostrum short, not quite reaching to the mesosternum. Rostral channel very shallow; posterior margin of pronosternum roundly excavated. Head with four rows of large pits, two along the median line and one on each side a little above the eye.

Pronotum faintly raised on the disk, shiny, coarsely pitted, unicarinate; humeri not prominent; calli brownish black; collum distinct; median carina present, but not prominent. Elytra evenly reticulated, long; costal area uniseriate, the areolæ moderately large; subcostal area triseriate, the areolæ very small; discoidal and sutural areas not differentiated. Areolæ hyaline. Length, 2.5 millimeters; width, 0.54.

Holotype (male) and allotype (female), Mount Maquiling, Luzon, Philippine Islands, Drake collection. Paratypes (male and female), Imugan, Nueva Vizcaya Province, and Mount Maquiling, in Baker collection. The third segment of the antennæ

is longer in the male than in the female (male = 37, female = 30). The form and color readily separate this species from *S. formosana* Matsumura.

SERENTHIA SEDALIS sp. nov.

Head and eyes black. Antenniferous tubercles short and blunt. Antennæ moderately long, brown, the third segment and sometimes the fourth dark brownish fuscous; segment I stouter and longer than II; III gradually becoming smaller toward apex, twice as long as IV, the latter clothed with longer hairs and distinctly longer than I. Rostrum stout, reaching to mesosternum.

Pronotum coarsely pitted, shiny, considerably swollen through the disk, unicarinate, the carina not prominent on the disk, black; marginal row of areolæ of collum and triangular process testaceous or brownish testaceous. Legs brown, moderately stout. Elytra rounded behind, testaceous or brownish testaceous; costal area composed of one row of moderately large areolæ; subcostal area very broad, quadriseriate; discoidal area distinct, narrowed at base and apex, with four to five rows of areolæ at widest part. Areolæ mostly hyaline. Length, 2 millimeters; width, 0.52.

Six specimens, Manila, Philippine Islands, Robert Brown collection. Holotype (male) and allotype (female) in United States National Museum. Paratypes in Drake collection and National Museum.

NEW SPECIES OF PYRAUSTINÆ FROM THE PHILIPPINE ISLANDS

By W. SCHAUS

Of the United States National Museum

THREE PLATES

Specimens of the following species, with the exception of two, were presented to the United States National Museum by Prof. C. F. Baker, of the College of Agriculture, Los Baños.

PILOCROCIS POLIALIS sp. nov. Plate 1, fig. 12.

Female.—Palpi hair brown, underneath pinkish buff. Body above pinkish buff; front of collar and shoulders fuscous black; body below white, the legs pinkish buff; a dark band on fore tibiæ. Wings pinkish buff, silky, suffused with light brownish drab, the lines very fine, fuscous; a terminal line; cilia silvery white or drab according to light. Fore wing: costa fuscous to postmedial line; an outbent antemedial line; a small spot in front of cell; a line on discocellular; postmedial line dentate with points on veins, almost vertical to vein 3, obsolescent and well inset, with outbent line from vein 2 to inner margin. Hind wing: a point on discocellular; postmedial line slightly outcurved, punctiform to vein 3, deeply inset, and sinuous from vein 2 to inner margin near anal angle. Wings below similar but paler.

Expanse, 35 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33215, United States National Museum.

PHOSTRIA HILLALIS sp. nov. Plate 2, fig. 2.

Female.—Head, collar, thorax, throat, fore femora and anal segment of abdomen primuline yellow; two black spots on thorax meeting in front; a black stripe from shoulder on tegulæ; two vertical black lines on mesothorax and a transverse bar on metathorax; abdomen black, the two basal segments yellowish overlaid with black hairs; legs black. Fore wing black; a primuline yellow spot at base of costa and cell, followed by a thick white line from subcostal, downbent and excurved to middle of

submedian vein, above it a large round antemedial white spot from within cell to below submedian; a small white spot at middle of cell, and a large round white spot over discocellular area, this spot larger than the antemedial spot; all the veins from cell, and outer half of submedian grayish white. Hind wing black; a broad white fascia from middle of costa abruptly upbent to base of inner margin and expanding to near anal angle, its outer edge sinuous at bend. Fore wing below black; a smaller antemedial spot; only a trace of spot in cell, the outer spot as large as above. Hind wing below as above.

Expanse, 37 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33216, United States National Museum.

Named in honor of Mrs. Gillett Hill, who contributed to the purchase of the Dognin Collection.

PHOSTRIA PRIMULOSALIS sp. nov. Plate 2, fig. 1.

Male.—Body above and wings light brownish olive, sometimes slightly darker. Body below hair brown, the long hairs on legs partly tilleul buff. Fore wing: antemedial, postmedial line and a line on discocellular blackish brown, rather thick, the antemedial outbent from costa, the postmedial slightly outcurved to vein 2 and inbent to inner margin, somewhat macular. Hind wing: very faint traces of a medial line; base of costa whitish. Wings below hair brown, with faint traces of postmedial line; inner margin of fore wing whitish.

Expanse, 34 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33217, United States National Museum.

Described from 4 males. The legs are fringed with hair as in *P. origoalis* Walker; the fore wing is broader, the apex less acute, the termen straighter, and the abdomen below is not white as in that species.

PHOSTRIA AENGUSALIS sp. nov. Plate 2, fig. 4.

Male.—Palpi, head, collar, and shoulders maize yellow. Thorax yellowish crossed by black lines, the anterior line also crossing the tegulæ. Abdomen above black dorsally mottled with yellow scales; anal hairs yellow tipped with black; body below yellow with black ventral spots. Wings maize yellow. Fore wing: costal margin black; termen black expanding on inner margin, narrow between veins 5 and 6, preceded by an elongated black spot; a subbasal black mark, narrow at costa, expanding

on inner margin; antemedial line outbent, curved along inner margin and upbent to costa beyond cell; a fine curved black line on discocellular posteriorly touching the upbent line. Hind wing: a medial thick black line; termen black expanding between veins 5 and 6, and below vein 2. Underside of wings the same, but without basal and antemedial line on fore wing.

Expanse, 18 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33218, United States National Museum.

Closely allied to *P. mimastis* Meyr.

PHOSTRIA CELSUSALIS sp. nov. Plate 1, fig. 3.

Female.—Body and wings maize yellow, the markings black; a transverse spot medially on collar behind; a small spot on shoulders; a large white spot on metathorax edged with black; dorsal and subdorsal spots on third segment of abdomen, the following three segments with smaller dorsal and lateral spots; anal hairs tipped with black. Fore wing: a subbasal spot on inner margin; a broad antemedial fascia, somewhat diffuse like conjoined streaks; a spot in cell and line on discocellular; a broad outer fascia projecting basad between veins 5 and 6, consisting of broad connected streaks, outwardly in part connected with cuneate spots to vein 2, then inset forming a large spot not touching inner margin. Hind wing: a spot in cell; a broad postmedial fascia of conjoined oval spots, those below vein 6 and vein 2 prolonged basad, also a point above vein 6; subterminal small spots below veins 8 to 6. Wings below very similar, the termen on fore wing from costa to vein 2 suffused with fuscous.

Expanse, 21 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33219, United States National Museum.

Belongs to same group as *P. aengusalis* sp. nov.

PHOSTRIA DRUONALIS sp. nov. Plate 2, fig. 6.

Male.—Palpi light buff; head white; collar and anterior half of tegulæ antimony yellow. Abdomen above fuscous black; lateral tufts wood brown, anal tufts light yellowish buff, abdomen below creamy white. Fore wing silky snuff brown with a purplish suffusion; costal margin antimony yellow; termen and apex golden light orange yellow; faint traces of a black postmedial line, outcurved beyond cell on edge of dark portion of wing; a faint black spot on discocellular; cilia silvery white.

Hind wing entirely silky fuscous, with faint traces of postmedial line; cilia tipped with white. Wings below pale orange yellow with a broad postmedial fuscous line preceded by purplish suffusions, more pronounced on fore wing.

Expanse, 17 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33220, United States National Museum.

Also belongs to the group of *P. aengusalis* sp. nov.

LAMPROSEMA ALICIALIS sp. nov. Plate 2, fig. 5.

Male.—Body and wings above silky olive brown suffused with purplish; palpi and body underneath white; legs white, fore femora and tibiæ olive brown; mid and hind tibiæ partly streaked with brown; anal hairs white. Wings: lines fine, blackish; a fairly large white spot at discocellulars inwardly edged with black; cilia tipped with white. Fore wing: antemedial line faintly outcurved; postmedial line almost vertical, faintly dentate, retracted at vein 2 and downbent. Hind wing: postmedial line as on fore wing, more distinctly dentate between veins 5 and 2. Fore wing below light drab, the discal spot smaller, the postmedial line as above; hind wing below paler than fore wing; a black line on discocellular, the white spot very faint; postmedial line as above. Palpi and legs normal.

Expanse, 24 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33221, United States National Museum.

A series collected by Prof. C. F. Baker.

In apearance very much like *Phostria discipunctalis* Hampson.

LAMPROSEMA BONITALIS sp. nov. Plate 2, fig. 8.

Male.—Body and wings above grayish hair brown, abdomen with fine segmental white lines. Body below white; legs ecru-drab, fore tibiæ darker. Fore wing: lines fine, black, the antemedial slightly outcurved, the postmedial faintly curved from costa to below vein 3, retracted to lower angle of cell, and slightly outcurved to inner margin; a bar on discocellular; a black terminal line; a pale line at base of cilia followed by a broader black line, the tips like wing. Hind wing: postmedial line retracted to cell at vein 2; terminal line as on fore wing; outer half of cilia pure white. Wings below pale ecru-drab, the postmedial line hardly visible.

Expanse, 21 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33222, United States National Museum. A series in the National Museum.

DICHOCROCIS DORSIPUNCTALIS sp. nov. Plate 1, fig. 5.

Male.—Head and body cream white; second joint of palpi laterally fuscous; a narrow fuscous line on front of collar and shoulders; subdorsal black spots on abdomen, and a dorsal spot on anal segment; abdomen below with segmental drab lines. Wings cream buff, the lines fine benzo brown, on costa of fore wing thicker and black; a terminal line, thicker on hind wing. Fore wing: a subbasal spot on costa; antemedial line straight, faintly outbent; a line on discocellular; postmedial broad on costa, vertical, incurved, lunular from vein 8 to vein 5, then well outcurved and punctiform to vein 2, inset and inbent from vein 2 to inner margin. Hind wing: a line on discocellular; outer line bluntly outbent between veins 5 and 2; cilia of both wings crossed by a dark line and tipped with white. Wings below similar, paler.

Expanse, 23 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33223, United States National Museum.

DICHOCROCIS GALMERALIS sp. nov. Plate 1, fig. 4.

Male.—Palpi white; a curved drab line on second joint. Frons white with a central drab line; vertex and collar cinnamon drab; thorax and abdomen white with some drab shadings. Legs white; fore legs with benzo brown bands. Wings white; a terminal benzo brown line; cilia white divided by some dark scaling. Fore wing: lines benzo brown; a subbasal line followed by a broad light cinnamon drab fascia; antemedial line at one third from base, vertical; medial space irrorated with light cinnamon drab, especially on veins beyond cell; a bar on discocellular; postmedial line inbent from costa near apex, slightly sinuous to vein 2, shortly inturned along vein 2 and wavily inbent to middle of inner margin; a subterminal cinnamon drab fascia expanding to inner margin. Hind wing: antemedial line broader on discocellular, benzo brown, narrower toward inner margin above anal angle, preceded along inner margin toward base by light cinnamon drab shading; medial space as on fore wing; postmedial line and subterminal fascia suffusing below vein 2 to anal angle. Wings below whitish; small spots on discocellulars; subterminal line fine; traces of subterminal dark shading.

Expanse, 17 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33224, United States National Museum.

SYLEPTA CATHANALIS sp. nov. Plate 3, fig. 9.

Male.—Head and body light orange yellow; fore femora orange buff; fore tibiæ cinnamon buff with a broad black band. Wings iridescent purple drab; fore wing light orange yellow at base; hind wing with maize yellow fringe on inner margin.

Expanse, 37 millimeters.

Habitat.—Surigao, Mindanao; Mount Maquiling, Luzon.

Type.—Catalogue No. 33225, United States National Museum.

SYLEPTA BANOSALIS sp. nov. Plate 2, fig. 3.

Male.—Body and wings avellaneous suffused with olive buff. Palpi below and throat white; abdomen underneath white. Fore wing: a faint darker antemedial line below cell; a point in cell, and larger spot on discocellular; postmedial line remote, obliquely curved, and inbent below vein 3, with fine dark streaks on veins, slightly outangled with a larger point below vein 2. Hind wing with a faint medial line, upturned below vein 3, not reaching inner margin.

Expanse, 40 millimeters.

Habitat.—Los Baños; Surigao.

Type.—Catalogue No. 33226, United States National Museum.

Described from one male and five females.

SYLEPTA BERAMBALIS sp. nov. Plate 3, fig. 3.

Male.—Antenna with scale tooth at base, the basal half of shaft with small clusters of cilia; legs normal. Body and wings above buffy brown; body underneath white. Fore wing: markings fine, fuscous; a faint wavy, inbent antemedial line; a small point in cell; a fine oblique bar on discocellular; postmedial line punctiform, slightly outbent from below costa, outcurved from vein 5 to near vein 2, inbent and slightly outcurved to inner margin; terminal half of cilia grayish. Hind wing with a medial punctiform line, well outcurved from vein 5 to vein 2; area below cell to inner margin and to near termen with rather long hairs. Wings below light buff suffused with avellaneous, chiefly on termen; lines as above, buffy brown; faint lines on discocellulars.

Expanse, 41 millimeters.

Habitat.—Surigao, Mindanao.

Type.—Catalogue No. 33227, United States National Museum.

SYLEPTA PETROALIS sp. nov. Plate 3, fig. 4.

Female.—Head, palpi, and metathorax light buff, body otherwise above antimony yellow, the second segment of abdomen whitish, the other segments with white segmental lines; the preanal segment edged behind with black. Wings capucine buff, the markings hair brown; cilia silvery gray with a hair brown line at base. Fore wing: a fine outbent line antemedially from costa to inner margin; a subbasal fuscous small spot on inner margin; a point in cell, and line on discocellular; postmedial line outbent and incurved from costa to vein 5, then outbent and dentate to close to vein 2, inbent and downturned to inner margin; smoky brownish suffusions through cell and on terminal area, leaving a clear capucine buff terminal line. Hind wing suffused with smoky brownish except on inner margin; a line on discocellular; postmedial line well upbent below vein 3; terminal line as on fore wing. Wings below light buff, the termen suffused with hair brown, the lines well marked; no antemedial line on fore wing.

Expanse, 24 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33228, United States National Museum.

A series in the National Museum.

SYLEPTA SIMEALIS sp. nov. Plate 1, fig. 1.

Male.—Palpi fuscous, white underneath. Head white with a blackish spot on frons. Body above mustard yellow; a fuscous line on front of collar and shoulders; abdomen with whitish segmental lines, and some subdorsal fuscous scaling anteriorly on second and third segments, also a transverse line on preanal segment. Body below silvery white. Wings mustard yellow, the markings mostly fuscous; cilia silvery white with grayish olive shades. Fore wing; costal margin deep grayish olive; a spot at base of cell; a fine subbasal vertical line; antemedial line fine, outbent, followed by a spot across cell, and a point below cell; a deep grayish olive line on discocellular edged on both sides with black; postmedial line incurved to vein 5, then outbent, finer, dentate to vein 2, retracted to vein 3 suffusing with a small dark shade at base of veins 3 to 5, incurved to submedian and outcurved across it; some olivaccous suffusions on termen. Hind wing: a thick line on discocellular; postmedial line incurved at costa to vein 5, then outbent and slightly incurved between veins 5 and 2, retracted and downbent to inner margin; a dark shade at apex. Wings below whitish buff, the markings fainter.

Expanse, 31 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33229, United States National Museum.

Described from several specimens; an unnamed specimen in the British Museum.

SYLEPTA ELPHEGALIS sp. nov. Plate 3, fig. 6.

Male.—Body and wings light brownish olive (type). Abdomen with seventh segment overlain in front with white hair. Palpi and body below white; legs white streaked above with light brownish olive; fore tarsi with similar rings. Fore wing: lines blackish; antemedial outbent to median, then vertical; a fuscous streak on discocellular; postmedial almost vertical to vein 2, slightly retracted and faintly inbent to inner margin; a pale line at base of cilia which are tipped with grayish. Hind wing with postmedial line and cilia as on fore wing. Wings below light drab; postmedial line fainter; a dark line on discocellulars of both wings.

Expanse, 28 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33230, United States National Museum.

Some specimens are darker. The species is easily recognized by the white hairs on abdomen.

SYLEPTA AZADESALIS sp. nov. Plate 3, fig. 7.

Male.—Head, thorax, base of abdomen, and wings hair brown; abdomen otherwise dorsally fuscous black with fine whitish segmental lines; all the tarsi with light buff rings. Fore wing: lines fuscous black, the antemedial from subcostal slightly outbent, more heavily marked on veins; a spot on discocellular; postmedial thick, vertical from costa to below vein 6, bluntly outcurved and coarsely dentate to vein 2, retracted toward cell and vertical to inner margin, outwardly defined by faint paler shading; a fine pale line at base of cilia, followed by a blackish shade, the tips glossy hair brown. Hind wing: postmedial line fuscous black, outwardly well edged with pinkish buff, but less so at the projecting dentate line between veins 2 and 5; terminal line and cilia as on fore wing. Wings below paler, more of a drab, the lines as above.

Expanse, 28 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33231, United States National Museum.

A long series of specimens in the National Museum.

The male has no special characters.

SYLEPTA MACAREALIS sp. nov. Plate 3, fig. 8.

Male.—Body and wings above buffy brown; palpi and legs light drab. Wings: lines fine, black; a fine pale line at base of cilia which are concolorous with the wing. Fore wing: antemedial line hardly perceptible, slightly outcurved from subcostal; an oblique line on discocellular; postmedial line gently outcurved, macular from costa to vein 2, angled and slightly inbent to inner margin, the point at angle more heavily marked. Hind wing: postmedial line macular, slightly outcurved. Abdomen and wings below whitish buff suffused with drab; black points on discocellulars; postmedial line blackish brown, more distinctly punctiform.

Expanse, 31 millimeters.

Habitat.—Surigao, Mindanao.

Type.—Catalogue No. 33232, United States National Museum.

Described from one male, two females presented to the National Museum by Mr. B. Preston Clark.

SYLEPTA MILDREDALIS sp. nov. Plate 2, fig. 9.

Female.—Body and wings above wood brown; base of palpi and throat white; body below light buff; fore legs hair brown with white rings; mid and hind legs chiefly light buff. Wings: lines fine, darker brown; a pale line at base of cilia. Fore wing: a sinuous antemedial line from median to inner margin; a point in cell; a short streak on discocellular; postmedial line inbent from costa, bluntly outcurved from below vein 5 to vein 2, retracted toward end of cell, angled and sinuous to inner margin. Hind wing with postmedial line bluntly outcurved between veins 5 and 2. Wings below buffish avellaneous; dark lines on discocellulars; postmedial somewhat punctiform, with a more prominent point at vein 5, below 5 not so bluntly outcurved.

Expanse, 32 to 37 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33233, United States National Museum.

Two females received from Professor Baker.

SYLEPTA DOTTOALIS sp. nov. Plate 1, fig. 2.

Male.—Head white, palpi partly shaded with wood brown. Collar and thorax white with some olive brown scaling. Abdomen white at base and on terminal segments; a carob brown spot on first segment, the next three segments hazel with a dorsal black line. Body below and legs white. Fore wing: a black line from costa at one fourth to inner margin near tornus where it is sharply angled and inbent along inner margin to a

vertical black antemedial line, the space within this triangle has a white line on submedian vein and is otherwise irrorated with lilac gray; some black and white scaling at base limited by an irregular black subbasal line, followed to antemedial line by a light buff space irrorated with brown; beyond the oblique line the costa is white, below it semihyaline cream white; a fine brown line on discocellular; a straight subterminal line, from costa near apex to vein 2, fine, fuscous; a fine brown line along vein 7 from cell to subterminal line; termen white with wood brown suffusions; a fine terminal brown line; cilia white. Hind wing: base and inner margin light buff suffused with wood brown; a fuscous black bar on discocellular; subterminal line fuscous black from costa to vein 2, retracted as a line of scales to bar on discocellular and downcurved to inner margin above a white patch at tornus; terminal area white suffused with wood brown except along a terminal dark brown line. Wings below white with the postmedial from costa to vein 2 only.

Expanse, male, 23 millimeters; female, 25.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33234, United States National Museum.

Near *S. chalybifascia* Hampson.

This species belongs to a section with the frons greatly produced.

MARGARONIA BAKERIALIS sp. nov. Plate 3, figs. 1 and 2.

Male.—Palpi natal brown, the base, a medial band, and tips ochraceous buff. Head hair brown, the frons laterally ochraceous buff. Collar and thorax benzo brown; an antilateral ochraceous buff line on collar extending shortly on tegulæ. Abdomen above verona brown mottled with sayal brown; anal segment metallic dark neutral gray, with silvery white shading; body below fuscous with some metallic blue scaling on terminal segments, the base with some ochraceous buff hairs; legs ochraceous buff circled with fuscous. Wings natal brown. Fore wing: base of costa ochraceous buff crossed by a black bar to median vein, an outset darker brown shade above inner margin; ochraceous buff streaks on either side of the two lines at costa, with the costal edge between the lines also ochraceous buff; antemedial line thick, slightly curved, and outbent, fuscous; a pale point in cell; postmedial line fuscous, thick, vertical from costa, inbent at vein 5, inclosing a small whitish spot, then downbent vertically close to middle of inner margin. Hind wing: a white line on discocellular, closely followed by a black median line outwardly

shaded with ochraceous buff to near anal angle. Wings below grayish drab. Fore wing: an oblique antemedial creamy white streak from subcostal to median vein; a point in cell, and a creamy white streak beyond cell from subcostal to vein 5. Hind wing: a white line on discocellular, and faint traces of the medial line.

Female.—Fore wing: the markings on costa deep chrome, more extended forming a complete subbasal line, on outer edge of antemedial reaching median vein, almost completely inclosing a natal brown spot; the postmedial is downbent to vein 3, curved and upbent basad to subcostal near middle of wing, the space within curve deep chrome on costa, below it to vein 3 maize yellow. Hind wing: a large oval maize yellow spot about discocellular, the medial line from vein 6 black edged on either side, but not completely with orange buff. Wings below with the spots maize yellow, as large as above.

Expanse, male, 35 millimeters; female, 38.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33235, United States National Museum.

Some males have the ochraceous costal markings almost obsolete. I take special pleasure in naming this fine species in honor of Prof. C. F. Baker.

MARGARONIA LUPINALIS sp. nov. Plate 2, fig. 7.

Female.—Body and wings above silky dark vinaceous drab; edge of palpi below, throat, and body white; venter suffused with buff white. A white line on either side of frons crosses vertex and collar, expanding on tegulæ; some white shading on basal segment of abdomen. Fore wing: an oblique white fascia from subcostal, narrowing at submedian, expanding below submedian into a small triangular spot; a postmedial oval white spot from below costal edge to vein 2; a fine white postmedial line expanding on costal edge; both antemedial fascia and postmedial spot edged with dusky drab; cilia partly tipped with white. Hind wing white on basal half; a dusky drab streak on discocellular; a postmedial white line from costa to termen close to anal angle, broadly edged inwardly with dusky drab; a dusky drab line along inner margin from base to anal angle. Wings below similar, the dark portion benzo brown.

Expanse, 25 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33236, United States National Museum.

Near *M. bicolor* Swains, distinguished by the complete white postmedial line, and streak on discocellular of hind wing.

CLINIODES TOTUANALIS sp. nov. Plate 3, fig. 5.

Female.—Head white; palpi rufous, underneath white at base; antennæ light drab, the first joint white. Collar and thorax opalescent pale drab gray, the former with a narrow yellow ocher band in front extending on shoulders. Abdomen silvery white, the dorsum largely light drab. Body below and legs white, the fore tarsi light ochraceous buff. Fore wing silvery drab tinged with olivaceous; costa yellow ocher with a dark shade on it from base to near middle, below subcostal a silvery white line to near apex with a projecting small triangular white spot at end of cell. Hind wing; costa silvery white, otherwise suffused with light drab. Fore wing below hair brown, the costa except edge, basal half, and inner margin white. Hind wings below white, the termen narrowly hair brown.

Expanse, 27 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33237, United States National Museum.

Close to *C. subcostalis* Walker from Borneo.

CROCIDOLOMIA SUBHIRSUTALIS sp. nov. Plate 2, fig. 10.

Male.—Palpi Hay's brown, the tips of each joint white; head white crossed by three brown lines; collar white with brown patches; thorax mottled brown and white, the tegulæ white with brown spots; abdomen above white at base, otherwise fuscous with white segmental lines; body below white. Fore wing mostly buffy brown with blackish brown irrorations medially in and below cell; white mottling at base; an antemedial interrupted white vertical line defined by brown scales; costa and front of cell medially, white, also the submedian and median veins; on discocellular an excurved white line with dark brown edges, the anterior edge expanding; postmedial line well outcurved lunular dentate, white, inwardly edged with black from costa to vein 4; costal edge warm buff; terminal area mottled with white; a marginal lunular white line, preceded by brown spots, outwardly edged by the black terminal line which is slightly indentate at veins; cilia brown with silvery shading. Hind wing hair brown; costa, base, and cell whitish; cilia light buff tipped with white. Wings below buff-white; fore wing with

a broad outer fuscous fascia to near termen; the tufts below cell prominent.

Expanse, 25 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33238, United States National Museum.

More variegated than *C. suffusalis* Hampson.

SAMEODES FINBARALIS sp. nov. Plate 1, fig. 6.

Female.—Body above warm buff, underneath white; fore and mid tibiæ and tarsi warm buff; hind tibiæ and tarsi white. Fore wing naples yellow. Hind wing semihyaline white faintly suffused with naples yellow.

Expanse, 29 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33239, United States National Museum.

SAMEODES ULRICALIS sp. nov. Plate 1, fig. 7.

Male.—Body avellaneous above, underneath white; legs avellaneous above, white below. Fore wing pinkish buff, the markings dark vinaceous drab; an interrupted streak on base of costa; a thick antemedial line slightly curved, followed by an elongated spot to below the large round discocellular spot; postmedial broad from below costa close to discocellular spot well outcurved, its inner edge diffuse below vein 3; cilia tipped with silvery white. Hind wing semihyaline white, suffused with light buff.

Expanse, 25 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33240, United States National Museum.

Hind wing below without the large fovea.

Several specimens in the National Museum, and an unnamed specimen in the British Museum.

SAMEODES ALEXALIS sp. nov. Plate 1, fig. 8.

Male.—Body and wings pale orange yellow; fore tibiæ tipped with black, the fore tarsi with white rings. Fore wing: a black spot at base of cell; a vertical antemedial dark vinaceous drab line, narrow on costa, expanding to inner margin where it extends to postmedial which is narrow on costa, vertical on inner edge, outbent on outer edge to near termen above tornus, and abruptly inbent, leaving the terminal portion of inner margin orange yellow; a small black spot at cell over veins 3 and 4. Hind wing: postmedial dark vinaceous drab, narrow on costa,

below vein 6 expanding and inbent to inner margin, bluntly projecting below vein 3. Wings below with the postmedial markings only, reduced and fainter.

The female similar.

Expanse, 27 millimeters.

Habitat.—Los Baños; Mount Maquiling, Luzon.

Type.—Catalogue No. 33241, United States National Museum.

Belongs to section II.

SAMEODES ODULPHALIS sp. nov. Plate 1, fig. 9.

Male.—Body and wings pale orange yellow. Tip of fore tibiæ fuscous, the tarsi with white rings; mid and hind tibiæ white. Fore wing: a small black spot at base of cell and a slightly larger spot covering the base of veins 3 and 4. Hind wing with inner margin silvery white.

Expanse, 26 millimeters.

Habitat.—Los Baños, Luzon.

Type.—Catalogue No. 33242, United States National Museum.

Belongs to section II (*Mimorista* Ware).

Three males received from Prof. C. F. Baker.

SAMEODES ENNODUISALIS sp. nov. Plate 1, fig. 10.

Female.—Body and wings light orange yellow, also the legs except fore tibiæ and tarsi which are like those of *S. odulphalis*. Fore wing: a small black spot at base of cell, and a slightly larger spot over base of veins 3 and 4; black antemedial and medial spots on inner margin and a small subterminal spot on vein 3. Hind wing below with a black medial spot on costa.

Expanse, 27 millimeters.

Habitat.—Mount Maquiling, Luzon.

Type.—Catalogue No. 33243, United States National Museum.

This may eventually prove to be the female of *S. odulphalis*.

POLYGRAMMODES EPHREMALIS sp. nov. Plate 1, fig. 11.

Male.—Head and body white; a hair brown spot on palpi; slight brownish suffusion on middle of frons; collar and tegulæ with some light buff suffusions; abdomen with segmental vinaceous buff lines, on second segment a chestnut brown line; anal hairs black. Fore wing buff white; a basal spot on median, subbasal spots on costa and inner margin and thick antemedial and medial lines, blackish brown; antemedial outcurved; medial line from a streak on costa outbent across discocellular, vertical and sinuous below it, preceded by a point

in cell; postmedial line finer, browner, angled on subcostal, vertical to vein 5, outset and slightly inbent to vein 2, below vein 2 an irregular spot narrowing on inner margin, a subterminal macular paler line, slightly outset below vein 5; a terminal olive brown line. Hind wing whiter, thinly scaled; faint dark scaling at lower angle of cell with a downbent line below it; postmedial fine, slightly outset at vein 5 and vein 2, from which point it is somewhat broader; a subterminal line from costa to vein 2; terminal line very fine.

Expanse, 38 millimeters.

Habitat.—Surigao, Mindanao; Mount Maquiling, Luzon.

Type.—Catalogue No. 33244, United States National Museum.

ILLUSTRATIONS

Plate 1

Fig. 1. *Sylepta simealis* sp. nov.
2. *Sylepta dottoalis* sp. nov.
3. *Phostria celsusalis* sp. nov.
4. *Dichocrocis galmeralis* sp. nov.
5. *Dichocrocis dorsipunctalis* sp. nov.
6. *Sameodes finbaralis* sp. nov.
7. *Sameodes ulricalis* sp. nov.
8. *Sameodes alexalis* sp. nov.
9. *Sameodes odulphalis* sp. nov.
10. *Sameodes ennoduisalis* sp. nov.
11. *Polygrammodes ephremalis* sp. nov.
12. *Pilocrocis polialis* sp. nov.

Plate 2

Fig. 1. *Phostria primulosalis* sp. nov.
2. *Phostria hillalis* sp. nov.
3. *Sylepta banosalis* sp. nov.
4. *Phostria aengusalis* sp. nov.
5. *Lamprosema alicialis* sp. nov.
6. *Phostria druonalis* sp. nov.
7. *Margaronia lupinalis* sp. nov.
8. *Lamprosema bonitalis* sp. nov.
9. *Sylepta mildredalis* sp. nov.
10. *Crocidolomia subhirsutalis* sp. nov.

Plate 3

Fig. 1. *Margaronia bakerialis* sp. nov., female.
2. *Margaronia bakerialis* sp. nov., male.
3. *Sylepta berambalis* sp. nov.
4. *Sylepta petroalis* sp. nov.
5. *Cliniodes totuanalis* sp. nov.
6. *Sylepta elphegalis* sp. nov.
7. *Sylepta azadesalis* sp. nov.
8. *Sylepta macarealis* sp. nov.
9. *Sylepta cathanalis* sp. nov.

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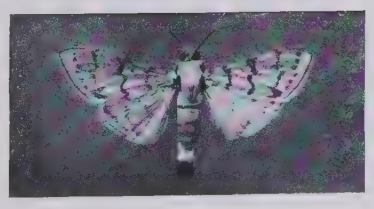

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PLATE 1.

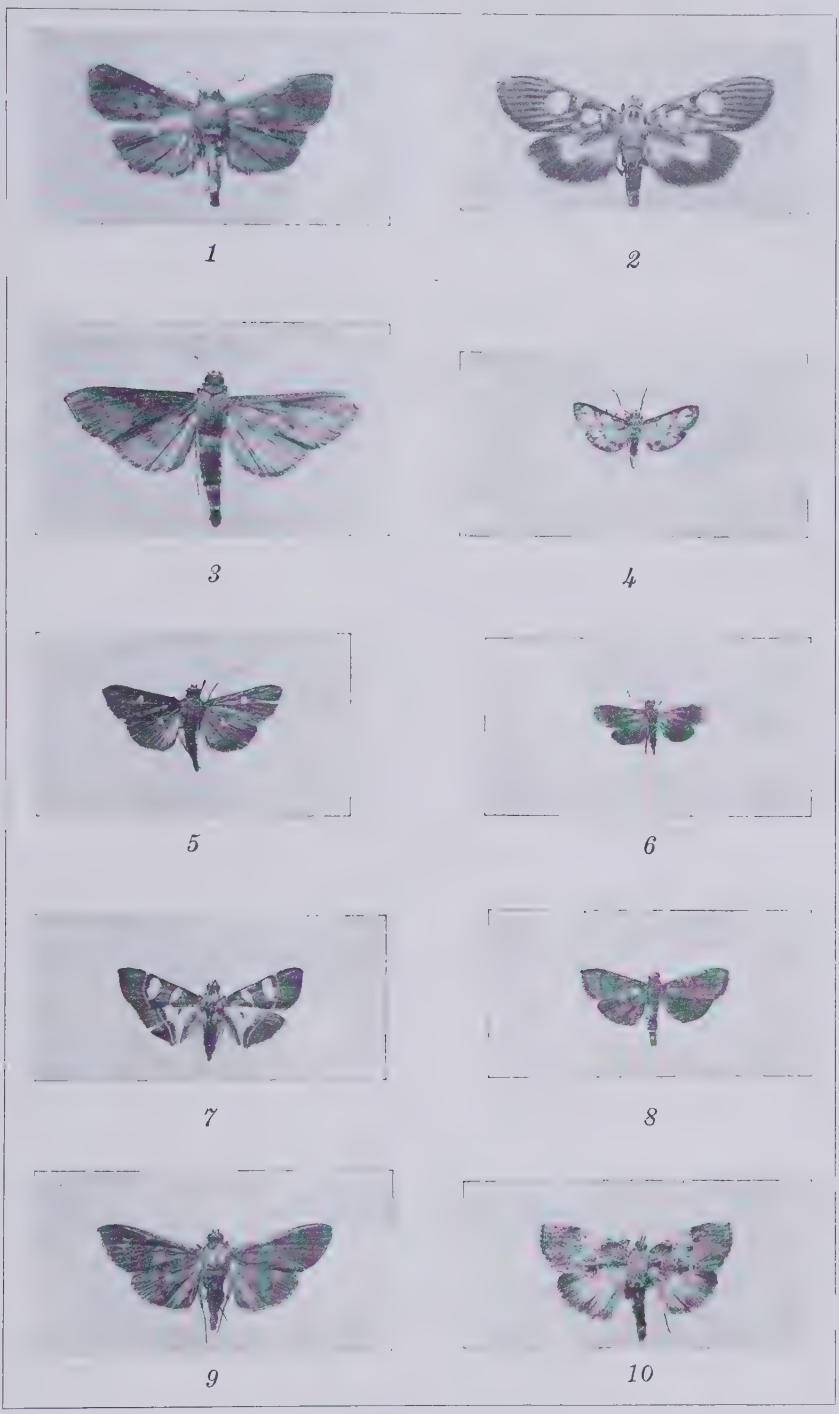

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PLATE 2.

PLATE 3.

DIE CONOPIDEN DER PHILIPPINEN

VON O. KRÖBER

Hamburg, Germany

EINE TAFEL

Als ich 1915 meine erste Arbeit über orientalische Conopiden schrieb, hatte mir von den Philippinen noch keine einzige Art vorgelegen. Durch Prof. M. Bezzi [1] ist dann die erste neue Art daher bekannt gemacht worden, *Stylogaster bakeri*. Heute liegt mir eine kleine Collektion von 40 Exemplaren vor, die sich auf 7 Arten verteilen, von denen 4 neu sind. Es scheint mir, als ob die Inseln des Orients überhaupt zu einer regen Neubildung von Arten und Unterarten neigen, so dass von diesen Gebieten noch viel neues und interessantes zu erwarten sein dürfte. Die vorliegenden Conopiden gehören nur 2 Gattungen an, während im ganzen aus der orientalischen Region 9 Gattungen mit 70 Arten bekannt sind. Dieselben verteilen sich folgendermassen: *Brachyceraea*, 1 Art; *Physocephala*, 22 Arten; *Conops*, 29; *Zodion*, 3; *Myopa*, 5; *Occemyia*, 5; *Sicus*, 2; *Stylogaster*, 2; und *Macroconops*, 1 Art.

Übersicht über die Unterfamilien und Gattungen.

1. Drittes Fühlerglied mit Endgriffel..... Unterfamilie **Conopinæ.**
   Drittes Fühlerglied mit Rückenborste..... 2.
2. Untergesicht stark gekielt, ohne Gesichtsgruben. Rüssel sehr auffallend lang und dünn; die Lippen lang fadenförmig, oft nach aussen umgerollt. Fühlerborste deutlich 3-gliedrig. Körper sehr lang und zart. Weib mit lang vorstehender Legeröhre.... Unterfamilie **Stylogasterinæ.** (Nur 1 Genus, *Stylogaster*, mit 2 Arten, *S. bakeri* Bezzi und *orientalis* Brun.)

   Untergesicht nie gekielt. Rüssel nie auffallend dünn und lang, oft sehr kurz, fast in der Mundhöhle verborgen. Fühlerborste 2-gliedrig. Weib mit unpaarem Organ (Theka) an der Bauchseite. Mann ohne fadenförmigen Anhang der Genitalien. Körper stets walzig, gedrungen ..... Unterfamilie **Myopinæ.**

Unterfamilie Conopinæ.

1. Drittes Fühlerglied nie das längste. Rüssel stets länger als der Kopf, stets chitinös, glänzend..... 3.

[1] Philip. Journ. Sci. 12 § D (1917) 157.

2. Drittes Fühlerglied weitaus das längste..... **Pleuroceriella** Brunetti.
3. Endglied des Fühlergriffels blattförmig, abgeplattet. Zweites und drittes Fühlerglied nahezu gleichlang. Abdominalspitze des Weibes nicht hakenförmig, sondern ein gleichmässig verjüngter Kegel. **Macroconops** Kröber.

   Endglied des Fühlergriffels borstenförmig. Analsegment des Weibes hakig umgebogen ..... 4.
4. Die kleine Flügelquerader steht hinter der Mitte der Discalzelle, mehr in ihrem letzten Drittel (flügelspitzenwärts). Erste Hinterrandzelle kurz. Hinterleib bedeutend länger als Kopf und Thorax zusammen, beim Mann besonders dünn gestielt. f und t mit merkwürdigen Schwellungen ..... **Physocephala** Schiner.

   Die kleine Querader steht auf der Mitte der Discalzelle. Erste Hinterrandzelle sehr lang gestreckt..... 5.
5. Fühler kurz, kaum kopflang, mit rundlichem Endglied. Griffel 3-gliedrig. **Brachyceraea** v. Röd.

   Fühler mindestens kopflang, meistens viel länger, mit spatelförmigem Endglied. Griffel oft nur 2-gliedrig..... **Conops** Linnæus.

MYOPINÆ[2]

1. Rüssel nur an der Basis gekniet..... **Zodion** Latreille.

   Rüssel an der Basis und in der Mitte gekniet..... 2.
2. Untergesicht stark verlängert, weit unter die Backen heruntergehend. Backen wenigstens doppelt so lang als der Augendurchmesser. Hinterleib bedeutend kürzer als die Flügel, oben plattgedrückt. **Myopa** Fabricius.

   Untergesicht nur mässig verlängert; Backen höchstens so lang wie der Augendurchmesser ..... 3.
3. Fühler viel länger als ihr Abstand vom Scheitel, meistens kopflang. Kleine schwarze oder graue Arten mit nie ganz rotgelber Stirn. Hinterleib kurz, namentlich im Weib..... **Occemyia** Robineau-Desvoidy.

   Fühler viel kürzer als ihr Abstand vom Scheitel. Grosse, rostbraun gefärbte Arten mit ganz rotgelber Stirn. Hinterleib des Weibes schmal, lang, weit umgebogen..... **Sicus** Scopoli.

ÜBERSICHT ÜBER DIE BISHER BEKANNT GEWORDENEN ARTEN

Physocephala albofasciata Brun., ♂ ♀, Rec. Ind. Mus. 7 (1912) 497. Ind. or.

Physocephala ammophiliformis Kröb., ♂, Archiv f. Naturg. 81 (1915) 122, t. 4, f. 25. Birma.

Physocephala annulifera Brun., ♂, Rec. Ind. Mus. 7 (1912) 498. Assam.

[2] Die Gattung *Pleuroceriella* Brunetti, die nach der Zeichnung eine echte Conopinæ mit Fühlergriffel ist, characterisiert der Autor folgendermassen: "3. antennal joint conspicuously long, more than twice as long as 2., subcylindrical, with distinct apical style." Ozellen finden sich auch bei Conopiden. Die Gattung würde m. E. zur ersten Unterfamilie gehören. (s. o.)

Physocephala argentifera BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 361. Bengalen.

Physocephala assamensis KRÖB., ♀, Archiv f. Naturg. 81 (1915) 121. Assam.

Physocephala atricornis BRUN., ♂, Fauna Brit. Ind. 3 (1923) 363. Lahore.

Physocephala aterrima KRÖB., ♂ ♀, Archiv f. Naturg. 81 (1915) 122. Sikkim.

Physocephala aurantiaca BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 358. Bengalen, Ceylon.

Physocephala aureopygia KRÖB., ♂ ♀, Archiv f. Naturg. 81 (1915) 123, 131. Sikkim, Australia.

Physocephala bicolor BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 357. Darjeeling, Nepal.

Physocephala bipartita DOL., ♂ ♀, Nat. Tijd. Ned. Ind. 17 (1858–1859) 100. Amboina, Sumatra, Palong Pegu.

Physocephala calopa BIG., ♂ ♀, Ann. Soc. Ent. France VI 7 (1887) 334. Pondicherry.

Synonym, *mundus* BRUN., Fauna Brit. Ind. 3 (1923) 361 [Conops]. Ind. or.

Synonym, *quadrata* BRUN., Rec. Ind. Mus. 9 (1913) 274. Ost Himalaya.

Physocephala diffusa BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 365. Bengalen.

Physocephala limbipennis MEIJ., ♂ ♀, Tijd. v. Ent. 53 (1910) 165. Bali, Semarang, Krakatau, Formosa.

Synonym, *annulata* KRÖB., ♂ ♀, Ent. Mitt. Berlin 2 (1914) 281; Archiv f. Naturg. 80 (1914) 60, und 81 (1915) 124.

Synonym, *amoena* i. l.

Physocephala lugens VOLL., Versl. Meded. K. Akad. Wetensch., 15 (1863) 10, f. 5. Borneo.

Physocephala nigrofasciata BRUN., ♂, Rec. Ind. Mus 7 (1912) 497. Koygar.

Physocephala nursei BRUN., ♂, Fauna Brit. Ind. 3 (1923) 360. Ind. or.

Physocephala rufescens BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 360. Kaschmir.

Physocephala sauteri KRÖB., ♂ ♀, Entom. Mitt. Berlin 2 (1913) 280. Formosa.

Physocephala scutellata KRÖB., ♂, Archiv f. Naturg. 81 (1915) 118. Birma.

Physocephala sumatrensis KRÖB., ♀, Archiv f. Naturg. 81 (1915) 119. Sumatra.

Physocephala tenella BIG., ♂ ♀, Ann. Soc. Ent. France VI 7 (1887) 35. Ceylon, Ind. or.

Brachyceraea obscuripennis KRÖB., ♂ ♀, Entom. Mitt. Berlin 2 (1913) 277. Formosa.

Conops annulosus BIG., ♂ ♀, Ann. Soc. Ent. France VI 7 (1887) 36. Molukken, Birma.

Conops brevirostris KRÖB., ♀, Archiv f. Naturg. 81 (1915) 53. Birma.

Conops celebensis MEIJ., ♂ ♀, Tijd. v. Ent. 53 (1910) 165. Celebes, Sikkim.

Conops claripennis BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 345. Ind. or.

Conops claripennis var. ceylonicus BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 346. Ceylon.

Conops erythrocephalus F., ♂ ♀, Ent. Syst. 4 (1850) 392. Ind. or., franz. Guinea, Lorenzo Marques.

Conops frontosus KRÖB., ♂, Archiv f. Naturg. 81 (1915) 57. Sikkim.

Conops gigas MACQ., ♀, Dipt. Escot. II 3 (1843) 10. Java.

Conops indicus KRÖB., ♂ ♀, Archiv f. Naturg. 81 (1915) 45. Sikkim.

Conops intermedius BRUN., ♂ , Fauna Brit. Ind. 3 (1923) 353. Ind. or.

Conops javanicus DOL., ♂ ♀?, Nat. Tijdsch. Ned. Ind. 10 (1856) 409, t. 4, f. 2. Java.

Conops maculiventris KRÖB., ♂ ♀, Archiv f. Naturg. 81 (1915) 50. Sikkim, Birma.

Conops morosa MEIJ., ♂ ♀, Tijd. v. Ent. 67 (1924) 213. Java.

Conops nigripes KRÖB., ♂ ♀, Entom. Mitt. Berlin 2 (1913) 278. Formosa.

Conops nigriventris BRUN., ♂, Fauna Brit. Ind. 3 (1923) 346. Assam.

Conops nigrofasciatus KRÖB., ♀, Archiv f. Naturg. 81 (1915) 46. Rangoon.

Conops nubeculosus BIG., ♂ ♀, Ann. Soc. Ent. France VI 7 (1887) 36. Ind. or., Australia.

Conops nubeculosus var. fulvicornis KRÖB., ♂, Entom. Mitt. Berlin 2 (1913) 279. Formosa.

Conops nubeculosus var. ornatus BIG., ♀, Bull. Soc. Zool. de France 17 (1892) 211. Ind. or.

Conops pactyas WALK., ♂ ♀, Dipt. Saund. 4 (1852) 255. Java, Birma.

Conops pseudogigas KRÖB., ♂, Archiv f. Naturg. 81 (1915) 55. Birma.

Conops punctifrons KRÖB., ♀, Archiv f. Naturg. 81 (1915) 52. Sikkim.

Conops rufifrons DOL., ♂ ♀, Nat. Tijdschr. Ned. Ind. 14 (1857) 412, t. 8, f. 1. Amboina.

Conops rufofasciatus BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 353. Simla.

Conops rufomaculatus KRÖB., ♂ ♀, Archiv f. Naturg. 81 (1915) 44. Formosa.

Conops sepulchralis BRUN., ♂, Fauna Brit. Ind. 3 (1923) 348. Assam.

Conops sumatrensis KRÖB., ♀, Archiv f. Naturg. 81 (1915) 49. Sumatra.

Conops teuthrediniformis KRÖB., ♂, Archiv f. Naturg. 81 (1915) 51. Birma.

Conops testaceus MACQ., Dipt. Exot. II 3 (1843) 9. Bengalen, Tasmania.

Zodion cinereum F., ♂ ♀, Ent. Syst. 4 (1794) 319. Simla, Europa.

Zodion griseum BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 375. Kaschmir.

Zodion montanum BRUN., ♀, Rec. Ind. Mus. 7 (1912) 499. Ind. or.

Myopa cincta F., ♂ ♀?, Ent. Syst. 4 (1794) 399. Ind. or.

Myopa dorsalis F., ♂ ♀, Ent. Syst. 4 (1794) 397. Bihar, Europa, Afrika sept.

Myopa nigriventris BRUN., ♂, Fauna Brit. Ind. 3 (1923) 380. Kaschmir.

Myopa picta Pz., ♂ ♀, Fauna German. 114 (1798) 22. Ind. or., Europa, Afrika sept.

Myopa testacea L., ♂ ♀, Syst. Nat. ed. 11 2 (1759) 1006. Kaschmir, Europa, Afrika sept.

Occemyia atra F., ♂ ♀, Spec. Ins. 2 (1781) 469. Simla, Europa, Afrika sept.

Occemyia caenovalva KRÖB., ♀, Archiv f. Naturg. 81 (1915) 104, t. 7, f. 49. Formosa.

Occemyia flavipes BRUN., ♀, Fauna Brit. Ind. 3 (1923) 383. Bombay.

Occemyia sauteri KRÖB., ♂ ♀, Archiv f. Naturg. 81 (1915) 103. Formosa.

Occemyia simillima MEIJ., Bijdragen tot de Dierkunde 18 (1914) 103. Java.

Sicus ferrugineus L., ♂ ♀, Fauna Suec. (1761) 1907. Sikkim, Europa.

Sicus vaginalis KRÖB., ♀, Archiv f. Naturg. 81 (1915) 88, t. 7, f. 51. Ind. or.

Stylogaster bakeri BEZZI, ♂ ♀, Philip. Journ. Sci. § D 12 (1917) 157. Philippinen.

Stylogaster orientalis BRUN., ♂, Fauna Brit. Ind. 3 (1923) 372. Ind. or., Ceylon.

Pleuroceriella dioctriaeformis BRUN., ♂ ♀, Fauna Brit. Ind. 3 (1923) 368. Simla.

Vorstehende Liste enthält noch alle bisher nicht gedeuteten Arten älterer Autoren, die nur auf Grund des Typenmaterials identifiziert werden könnten, von denen zum Teil nicht einmal klar angegeben werden kann, ob ihr Platz in der betreffenden Gattung berechtigt ist.

Dieser verhältnismässig grossen Zahl orientalischer Conopiden gegenüber ist die der Philippinen bis jetzt nur bescheiden zu nennen. Nur fünf der bekannten Arten sind in der vorliegenden Collektion enthalten, doch kommen vier neue Spezies dazu: *Physocephala bipartita* Dol., ♂ ♀ ; *P. limbipennis* Meij., ♂ ♀ ; *P. philippinensis* sp. nov., ♂ ♀ ; *Conops bakeri* sp. nov., ♂ ♀ ; *C. nubeculipennis* Big., ♀ (var.) ; *C. nubeculipennis* var. *ornatus* Big., ♀ ; *C. olivaceus* sp. nov., ♂ ♀ ; *C. philippinensis* sp. nov., ♂ ; und *Stylogaster bakeri* Bezzi, ♂ ♀.

Das gesammte Material ist von Herrn Prof. Baker persönlich zusammengetragen und ist in vorzüglichem Erhaltungszustand, so dass zu manchen Beschreibungen älterer Arten ergänzende Zusätze gemacht werden können.

229950——7

Genus PHYSOCEPHALA Schiner

Bestimmungstafel der Physocephala-Arten.

1. Die Flügelbinde ist vor der Spitze plötzlich abgebrochen; Flügelspitze absolut hyalin..... **P. limbipennis** de Meijere.
   Die Flügelbinde reicht bis zur Spitze selber; also die ganze Unterrandzelle ist braun..... 2.
2. Kleine zarte Art mit wenig intensiven Schillerbinden. Flügelborderrand bis r_3 braun..... **P. bipartita** Doleschall.
   Grosse (12 bis 18 mm[3]) tiefschwarze Art mit intensivem Goldschimmer an Kopf und Thorax. Flügelbinde sehr dunkel, bis r_5 reichend.
   P. philippinensis sp. nov.

PHYSOCEPHALA LIMBIPENNIS de Meijere.

Zwei Männer: Cuernos Mountains, Negros; 8 Männer: Cuernos Mountains; Malinao, Tayabas; Dapitan, Mindanao.

Mann, Länge 7.2 bis 8 mm; Fühler fast 1 bis 1.3 mm; Flügellänge 4.5 bis 5.5 mm; Flügelbreite 1.1 bis 1.7 mm.

Untergesichtsmitte fast glänzend schwarz. Zweites Fühlerglied durch die dichte Beborstung der Oberseite und Spitze fast schwarz erscheinend. Endgriffel sehr kurz. Spitze und Seitenfortsatz fast gleich lang. Toment des Mesonotums und Abdomens durchaus silberweiss (nicht goldgelb). Hinterleib dünn gestielt, schwarzbraun, nur die Grenze des zweiten und dritten Tergits roströtlich. Flügel absolut hyalin. Das Ende der Discalzelle und Unterrandzelle hinter der plötzlich abgebrochenen Binde ohne jede Spur von Braunfärbung. f_3 mehr als zur Hälfte braunschwarz, k schwarz; Metatarsus der p_1 und p_2 heller.

Weib, Länge 6 bis 8.5 mm; Fühler 1.1 bis 1.5 mm; Flügellänge 5 bis 6 mm; Flügelbreite 1.3 bis 2 mm.

In der Färbung stark variabel! Theka in der Regel rostrot, zuweilen ganz schwarzbraun, stark glänzend. Schwinger sattgelb mit braunem Stiel. Hinterleib ganz schwarzbraun, mit blassgelblichem oder rein silberweissem Schiller. f_3 fast ganz schwarzbraun, t_3 schwarzbraun mit weisslicher Basis. Die letzten Segmente ziemlich lang und dicht schwarz behaart. Backen in der Regel braun. Ein Weib hat gelblichen Schiller auch auf den Seitenplatten des Hinterrückens und am Abdomen. Bei einem Weib sind die Gesichtsgruben ganz schwarzglänzend. Ein Weib von Mindanao ist vollkommen hell rostbraun mit gelblichem Schiller, nur die Thoraxplatte und das Schildchen sind

[3] Die Länge der Tiara ist immer ohne die Fühler angegeben; letztere sind extra gemessen.

schwarz. p braun, fast ohne jede Verdunkelung. Gesichtsgruben nur leicht gebräunt.

PHYSOCEPHALA BIPARTITA Doleschall.

Acht Männer: Dapitan, Surigao, Davao, Mindanao. Mount Maquiling, Luzon.

Sieben Weiber: Davao, Surigao, Kolambugan, Dapitan, Mindanao. Sibuyan.

Mann, Länge 9 bis 10 mm; Fühler 2 bis 2.2 mm; Flügellänge 6 bis 6.5 mm; Flügelbreite 1.7 bis 2 mm.

Weib, Länge 8 bis 9 mm; Fühler fast 2 bis 2.4 mm; Flügellänge 5.5 bis 7.2 mm; Flügelbreite 1.6 bis 2 mm.

Die Art ist ziemlich weit verbreitet und recht variabel, mit entschiedener Neigung zur Bildung von Lokalrassen, wozu die Isolierung der vielen Inselgruppen wohl beiträgt. Vielleicht bildet sie mit der vorigen und diversen andern Arten einen grossen Formenkreis. Von *limbipennis* Meijere unterscheidet sie sogleich die vollkommen braun tingierte Unterrandzelle.

Mann, Fühler hell rotgelb, drittes Glied etwas länger als das erste. Hinterkopf an den Seiten intensiv gelbschimmernd. Thorax vor dem Schildchen düster rotbraun. Schildchen schwarzbraun. Hinterrücken schwarz. Brustseiten rostbraun mit ziemlich scharf begrenzter gelber Schillerstrieme. Hüften schwarzbraun messinggelb glänzend. p rostrot. f oben mehr oder weniger verdunkelt, f_3 fast der Länge nach. Basis von t_3 fast weissgelb. Schwinger sattgelb, die äusserste Stielbasis bräunlich. Zweites und drittes Abdominalsegment an der Basis rostrot. Alle Hinterleibsschiller gelb.

In hellen Exemplaren ist der Hinterleib vorherrschend rostbraun, nur die Mitte der Segmente mehr oder weniger verdunkelt. p rostbraun, eigentlich ohne jede Verdunkelung. Manchmal liegt vor dem Schildchen eine intensiv goldgelbe Tomentbinde.

Weib gleicht in allem dem Mann. Helle Exemplare sind fast ganz rostbraun. Die Theka ragt etwas weiter vor als die Abdominalspitze. Dunkle Tiere sind fast ganz schwarzbraun mit schwarzbrauner Theka, aber die p sind dann auch rostrot. In einigen Weiber ist der Schiller des Hinterleibes prachtvoll goldgelb. Die Färbung der Flügelbinde schwankt zwischen hellbraun und schwarzbraun.

Sehr nahe steht entschieden *P. argentifera* Brun.

PHYSOCEPHALA PHILIPPINENSIS sp. nov.

Gehört in die nächste Verwandtschaft von *P. sauteri*, *ammopuiliformis*, und *aterrima*, ist aber von allen deutlich verschieden.

Mann, Länge 18 mm; Fühler 3.4 mm; Flügellänge 11 mm; **Flügelbreite 3.4 mm.**

Kopf dunkel gelbbraun, ziemlich glanzlos. Stirn vor der Scheitelblase von Auge zu Auge dunkelbraun. Diese Zone verschmälert sich dann und endet als feiner senkrechter Strich am Fühlerhöcker. Untergesicht weisslichgelb mit kleiner A-förmiger schwarzglänzender Makel auf dem Kiel. Backen und Augenhinterrand dunkelbraungelb, letzterer intensiv goldgelbglänzend tomentiert. Hinterkopf im übrigen dunkelbraun. Fühlerhöcker tief schwarz. Ein hufeisenförmiger Fleck kommt dadurch zu Stande, dass zwei Streifen bis zur Höhe des Mittelflecks neben den Gesichtsgruben herabsteigen. Rüssel rostbraun mit schwarzer Spitze. Fühler lang und schlank, schwarz. Erstes und drittes Glied unterseits rostrot. Erstes ca. 3 mal so lang als breit; zweites ca. 2 bis 2.5 mal so lang als das erste; drittes so lang wie das erste. Endgriffel kurz zweispitzig. Thorax oben sammetschwarz. Schulterbeulen, Seiten- und Hinterrand mattbraun mit wundervoll intensivem Goldglanz. Der Schulterfleck findet seine Fortsetzung in einer breiten Binde der Brustseiten, die sonst glanzlos schwarzbraun sind. Schildchen mattschwarz mit reinbraunem Hinterrand. Hinterrücken tiefschwarz, oben schmal goldschimmernd, desgleichen auf den Seitenplatten. Schwinger sattgelb, die Knöpfchenspitze fast orange; äusserste Stielbasis bräunlich. Hüften schwarz mit fast weissgelbem, intensivem Schiller. p rostrot. Tarsen tiefschwarz. f und t mit äusserst kurzer, zerstreuter, angedrückter Beborstung. f zart weiss bestäubt. Aussenseite der t fast messinggelb glänzend. f_3 oben fast der Länge nach schwarz. t_3 seitlich weiss schimmernd. Haftläppchen gelblich. Klauen schwarz. Flügel etwas schwarzbräunlich getrübt mit tief schwarzbrauner Strieme, die vom Vorderrand bis zur Spitze und bis zur fünften Längsader reicht. Spitze der ersten Hinterrandzelle und Raum unterhalb dieser Zelle getrübt. Hinterleib sehr schlank, schwarzbraun, fast glanzlos. Vom Ende des zweiten Ringes an schwarz. Zweiter Ring fast die Hälfte des Körpers betragend. Ende des ersten etwas gelblich bereift. Ende des zweiten an den Seiten etwas goldgelb, nach oben schnell abnehmend. Das dritte und vierte ganz tief schwarz, glanzlos und glanzlos schwarz anliegend behaart. Analsegment weiss bestäubt, daher fast bläulich erscheinend.

Ein Mann von Samar.

Weib, Länge 12 bis 20 mm; Fühler 4 mm; Flügellänge 9.6 bis 11 mm; Flügelbreite 2.6 bis 3.1 mm.

Gleicht in allen Teilen dem Mann. Der Untergesichtsfleck ist kleiner. Rüssel fast ganz schwarz. Fühler von etwas andern Bau als beim Mann. t_1 unten der Länge nach verdunkelt durch die sehr dichte kurze Behaarung. Vordertarsen rostrot, durch schwarze Behaarung dunkel erscheinend. t_2 und t_3 und f_3 an der Oberseite weniger ausgedehnt schwarz. Die ganzen p eigentlich nur weiss bereift, ohne jeden intensiven Silberglanz. Hinterleib viel kürzer und robuster als beim Mann. Zweites und drittes Segment fast von gleicher Länge, braun, mit rötlichem Schein, fast glanzlos. Die Seiten sind fein weissgelb bestäubt am ersten bis dritten Tergit; die Mitte bleibt glanzlos in jeder Beleuchtung. Basis des dritten Tergits und die ganze Unterseite des dritten Sternits hellrostrot. Hinterrand des dritten Tergits jederseits mit scharf isoliertem blassmessinggelbem Tomentfleck. Vierter und fünfter Ring tief schwarz mit feinem bräunlichen Hinterrandsaum. Theka stark glänzend, schwarz, weiter vorragend als die Analspitze. Sechstes und siebentes Segment schwarz, etwas glänzend weiss bereift, daher bläulich erscheinend. Färbung der Flügel minder intensiv. Zweite Basalzelle fast hyalin, ebenso das Ende der ersten Hinterrandzelle. Flügelhinterrand vollkommen hyalin.

Zwei Weiber von Kolambugan und Surigao, Mindanao.

Von *P. bicolor* Brunetti unterscheidet sich die neue Art sofort durch den deutlich 2-gliedrigen Endgriffel, der bei *bicolor* 3-gliedrig sein soll, ferner durch gelbbraune, nicht schwärzliche Backen, rein schwarzen Thorax und Schildchen; Pleuren schwarz mit deutlicher goldgelber Strieme.

Bei der grossen Variabilität namentlich der *Physocephala* Arten aus der *pusilla*-Gruppe, ist es immer schwierig, Einzelstücke scharf vom Arttypus zu trennen. Wie ich bei den aegyptischen Arten nachweisen konnte lässt ein sehr reiches Material der verschiedensten Fundorte und Jahreszeiten manche Grenze verschwinden, die man auf Grund eines Einzelfundes in einem besonders isolierten Gebiet gezogen hat. So scheint mir auch bei *P. limbipennis* de Meijere die Variabilität zu verschiedenen andern Arten hinüberzuführen. *Physocephala annulifera* Brunetti, Mann, scheint sich nur durch belanglose Kleinigkeiten zu unterscheiden: eine ausgesprochene Stirnmakel, gelbes Toment, schwärzliche Schwinger. Eine Cotype von *limbipennis* de Meijere des Budapester Museums war in der Unterrandzelle

bis zur Flügelspitze leicht braun, tingiert, würde also der Art *P. munda* Brunetti entsprechen oder doch ihr sehr nahe kommen: "wings-band dying away gradually at about tip of second vein." (Meine var. *amoena* i. l.) Ob auch *calopus* Bigelow zum Formenkreis von *limbipennis* gehört, vermag ich nicht zu sagen. Brunetti sagt: "Thorax brownish-yellow or orange brown;" Bigelow sagt: "Thorax schwarz, Pleuren rostrot." Nach der Originaldiagnose soll aber die Unterrandzelle grau sein, würde also überhaupt die *pusilla*-Gruppe ausscheiden, in der sie vollkommen braun ist.

Genus CONOPS Linnæus

Die von den Philippinen vorliegenden *Conops*-Arten machen die von mir aufgestellten provisorischen Gruppen unhaltbar, da sie in keine derselben so recht hineinpassen. So hat auch Brunetti keine befriedigende Bestimmungstabelle der *Conops*-Arten aufstellen können, was wohl zum Teil an der Variabilität gewisser Arten liegt.

Alle Tiere gehören in die Gruppe mit deutlichen schwarzen oder rotgelben Sammetmakeln an der Grenze von Stirn und Scheitel.

Bestimmungstafel der Conops-Arten.

1. Grosse schwarze Art mit schwarzen Fühlern und satt braunvioletten, stark irisierenden Flügeln..... **C. philippinensis** sp. nov., Mann.
   Schwarz und rostbraun gefärbte Arten mit rostroten, oft sehr hellen Fühlern (bei *olivaceus* ist nur das erste Glied rostrot) und bleich braun tingierten Flügeln, die nur eine dunklere Vorderrandbinde oder einen dunklen Apikalfleck tragen..... 2.
2. Flügel mit mehr oder weniger deutlichem Apikalfleck. Drittes und viertes Tergit schwarz, ohne helle Tomentbinde.
   C. nubeculosus Bigelow und Var.
   Flügel mit mehr oder weniger deutlicher Vorderrandbinde..... 3.
3. Grosse Art mit prachtvollem Goldtoment am ganzen Körper. Hinterleib mit ausgesprochener goldgelber Bandierung am ersten bis vierten Tergit. Fühler hellrotgelb..... **C. bakeri** sp. nov., Mann und Weib.
   Kleine, dunkle Art mit kaum erkennbarem, gelblichem Reif am Hinterleib, der den Grundton desselben in ein unbestimmtes Olive verwandelt.
   C. olivaceus sp. nov., Mann und Weib.

CONOPS PHILIPPINENSIS sp. nov., Mann.

Diese Art ist sicher nahe verwandt mit *C. niponensis* Voll., vielleicht das andere Geschlecht, aber es fehlt jeglicher violette Schein und das zweite Sternit ist zum Teil rostrot. Vielleicht handelt es sich aber um ein nicht vollkommen ausgefärbtes Exemplar (die Beinfärbung spricht dafür), so dass der Schiller noch nicht zur Wirkung kommt.

Länge 19 mm; Fühler 5.2 mm; Flügellänge 1.1 mm; Flügelbreite 4.9 mm.

Samar.

Kopf rotgelb, glanzlos, nur das Untergesicht am Mundrand und der untere Augenrand sind glänzend silberweiss. Gesichtsgruben zitronengelb, glanzlos. Scheitel etwas heller gelb, mit breiter, schwarzer Mittelstrieme, mit der Breite des Fühlerhöckers beginnend, dann spatelförmig ausladend und dann wieder eingezogen bis zum glänzend schwarzen Ozellenfleck, der zwei rotbraune, glänzende Ozellen trägt. Der Augenrand ist auf kurze Strecke von einem feinen schwarzen Sammetstrich begleitet, unterhalb dessen isoliert der schwarze Tomentfleck liegt. Hinterkopf rötlich gelbbraun, an den Seiten rein kastanienbraun, unten breit silberschimmernd, am Augenrand bis zur Scheitelblase linienfein silberweiss eingefasst. Untergesichtskiel schwärzlich. Rüssel etwas länger als der Kopf breit, ziemlich dick, schwarz, an der Basis rostbraun. Fühler tiefschwarz, glanzlos, das dritte Glied mit etwas rötlichem Ton, desgleichen das erste an der Unterseite. Erstes Glied ca. 3 mal so lang als breit; das zweite ca. 3 mal so lang als das erste, dicht, aber kurz schwarz behaart; das dritte so lang wie das erste, breit kegelförmig. Endgriffel 2-gliedrig, Seitenfortsatz mässig gross; das Endglied in eine starke Borste ausgezogen. Thorax schwarz, fast glanzlos, infolge Tomentierung olive erscheinend. Schulterbeulen gelbbraun, glanzlos, innen von einem feinen, gelbschimmernden Strich eingefasst, der, von hinten betrachtet, sich fleckenartig verbreitert. Schildchen und Hinterrücken oliveschwarz, letzterer oben etwas gelbgrau schimmernd. Seitenplatten gelb tomentiert. Brustseiten schwarzbraun, durch Toment olivengrünlich, ohne Schillerstrieme, nur etwas bereift. Die p erwecken den Eindruck der Unreife; sie sind gleich den Vorderhüften glanzlos gelbbraun. f oberseits schwärzlichbraun, das Spitzendrittel fast rundherum verdunkelt. Die hellen Partien etwas silbrig glänzend. t an der Spitze schwärzlich verdunkelt. Dann folgt eine auffallend hellgelbbraune Partie, dann sind sie bis zur Basis verdunkelt. t_1 innen fast ganz schwarz. Toment gelb. Alle Tarsen tiefschwarz. Haftläppchen und Klauen gelb, Spitze der letzteren schwarz. Schwinger satt ockerfarben. Hinterleib schlank, tief schwarz, fast glanzlos. Zweites Sternit etwas rostbräunlich. Hinterränder des ersten bis dritten Tergits fein weiss tomentiert, seitlich verbreitert sich das Toment. Das fünfte bis siebente Tergit stärker glän-

zend, mit ganz schwach bläulichem Ton. Flügel satt braun tingiert, prachtvoll irisierend, am Hinterrand kaum etwas heller.

Sehr nahe scheint auch *C. morosa* de Meijere zu stehen.

CONOPS NUBECULOSUS Bigelow, Weib, Var.

Mir scheint diese Art mit *ornatus* Big. und *fulvicornis* Kröb. einen Formenkreis zu bilden, und ich fasse die letzteren als Varietäten auf. Die Stammform hat nur eine fleckenartige Thoraxstrieme, die Varianten drei deutliche Striemen; *ornatus* hat das dritte und vierte Tergit schwarz, und die Fühlerborste weiss, t weiss tomentiert; *fulvicornis* ist nur an den Seiten des zweiten Tergits rotbraun, die t goldgelb tomentiert. Das scheinen mir höchstens lokale Rassen zu sein. Die Sammetflecken der Stirn sind für gewöhnlich tief schwarz, im vorliegenden Weib rotbraun.

Länge 13 mm; Fühler 3.5 mm; Flügellänge 10.3 mm; Flügelbreite 3.4 mm.

Surigao, Mindanao.

Stirn und Scheitel rein hellrotbraun mit mehreren concentrischen Furchen. An der Grenze liegt ein wenig auffälliger rotbrauner, nicht schwarzer Sammetfleck. Untergesicht und Backen satt ockergelb mit glänzenden Toment, nur die Gesichtsgruben sind weissgelb, lackiert, ohne Goldtoment. Rüssel rostbraun mit schwarzer Basis und schwarzbraunen Lippen. Fühler hellrotgelb. Das erste Glied 4 mal so lang als breit, kurz, spärlich, schwarz beborstet. Das zweite Glied ca. doppelt so lang als das erste, etwas dichter kurz schwarz beborstet, daher etwas dunkler erscheinend. Das dritte Glied von der Länge des ersten, heller erscheinend. Endgriffel deutlich 3-gliedrig, weiss schimmernd; das zweite Glied mit kleinem Seitenfortsatz, Endglied in eine lange Borste endigend, deren Spitze schwärzlich verdunkelt ist. Scheitelblase rostbraun. Hinterkopf sonst schwarzbraun, mit starkem, weissem Glanz am Augenrand, der quer über die Scheitelblase verläuft. Thorax im Grunde dunkelrostrot mit drei schwarzen Striemen, von denen aber nur die mittlere deutlich ist. Ein gelblicher Schimmer lässt den gesamten Thorax olive erscheinen. Schulterbeulen rostrot. Brustseiten rostrot mit weisslichen Reif, ohne eigentliche Schillerstrieme. Schildchen rostrot. Hinterrücken und Seitenplatten schwarz, aber dicht gelblich tomentiert. p hell rostbraun; Spitzen der t_3 und die Tarsen schwärzlich. Beborstung der f und t spärlich, schwarz, kurz, der Tarsen dicht und schwarz, besonders an den Seiten. Haftläppchen gelb, Klauen gelb mit schwarzer Spitze. Schwinger ockergelb. Erstes Tergit schwarzbraun, gelblich to-

mentiert; zweites rotbraun, durch gelblichen Schimmer olive; drittes oben schwarz, an den Seiten düster braungelb, in Seitenansicht am Hinterrand etwas gelbglänzend; viertes schwarz, glanzlos, nur am Hinterrand in Seitenansicht goldgelb tomentiert; fünftes ganz goldgelb. Theka gelbbraun, die Seiten durch gelbes Toment olive, sechstes und siebentes hell rotbraun, goldgelb tomentiert. Flügel gelblich mit ganz unscharfem, schwärzlichem Apikalfleck.

CONOPS NUBECULOSUS Bigelow var. ORNATUS Bigelow, Weib.

Länge 9 mm; Fühler 2.5 mm; Flügelbreite 2.2 mm; Flügellänge 7.6 mm.

Kolambugan, Mindanao.

Gleicht der Stammform in allen Stücken, aber das Griffelendglied ist ganz hellrotgelb, weiss schimmernd. Scheitelflecke sammetschwarz. Scheitel längs den Augen linienfein weissglänzend. Toment des Hinterkopfes silberweiss. Thorax mit drei klaren, schwarzen Striemen auf rostroten Grund, weisslich tomentiert. Brustseiten rostrot, über den Mittelhüften schwärzlich. Toment weisslich, keine Schillerstrieme. Erstes und zweites Tergit rostrot, weisslich tomentiert; drittes schwarz, seitlich etwas rostbräunlich, gleich dem tiefschwarzen vierten. Ring nur bei äusserster Seitenansicht etwas weisslich bereift. Fünftes bis siebentes dicht gelblich bestäubt; sechstes und siebentes rostrot. Theka düster gelbbraun. Flügel blasser gelb tingiert mit intensiverem Apikalfleck. p wie in der Stammform.

CONOPS BAKERI sp. nov., Mann und Weib.

Vier Weiber von nordwest Panay, Surigao, Mindanao. Ein Mann von Samar.

Weib, Länge 11 bis 16 mm; Fühler 4 bis 5.5 mm; Flügellänge 10 bis 13 mm; Flügelbreite 3.5 bis 4.5.

Mann, Länge 13 mm; Fühler 5 mm; Flügellänge 10 mm; Flügelbreite 3.5 mm.

Mann, Kopf gelborange mit intensivem Goldschimmer bis zum Scheitel. Gesichtsgruben heller, lackiert. Stirn und Scheitel rein hellbraun, erstere mit concentrischen Längs- und Querfurchen. Am Augenrand tritt je nach der Beleuchtung stückweise eine haarfeine goldgelbe Linie auf. Sammetflecken klein, dem Auge nicht direktanliegend. Rüssel düster rotbraun, ziemlich stark, ca. 2 mal kopflang, an den Enden schwärzlich. Fühler hellrostbraun. Erstes Glied 4 mal länger als breit, an der Basis oben mit kleinem dunklen Fleck, der schwarz beborstet ist. Sonst trägt nur die Unterseite etliche starke schwarze

Borsten. Zweites Glied ca. 1.5 mal so lang als das erste, dunkler, dicht schwarz beborstet. Drittes Glied so lang wie das erste, breit kegelig, hellrostrot. Griffel deutlich 3-teilig, in eine Borste ausgezogen, die zur Hälfte tief schwarz ist. Hinterkopf hellbraun, unten cremefarben, mit gelblichem Schimmer, der quer über die Scheitelblase streicht. Thorax tiefschwarz, vollkommen glanzlos, mit prachtvoll sattem Goldtoment. Schulterbeulen düster gelbbraun, innen goldgelb umsäumt. Der ganze Thorax wird rundherum von dieser Goldlinie umzogen. Auf der Platte erscheinen vorn die Anfänge von drei feinen goldgelben Linien, die bis zur Quernaht reichen. Schildchen, Hinterrücken, Seitenplatten tiefschwarz, satt goldgelb tomentiert. Hinterleib schwarz, durch Toment olive erscheinend, kurz und zerstreut schwarz behaart. Erstes bis fünftes Tergit mit prachtvoller, breiter Goldbinde am Hinterrand, die zum Teil auf gelbbraunem Grund liegt. Sechstes Tergit fast ganz goldgelb, aber glanzlos; Genitalapparat gelbbraun, glanzlos. Seiten des Hinterleibes mit gelbbräunlichem Ton. Pleuren düster rotbraun und schwarz, mit sattgoldgelber, intensiv glänzender Binde. Hüften schwarz, intensiv goldgelb tomentiert. f und t hellgelbbraun, kurz zerstreut schwarz beborstet. f zart weisslich bereift, t goldgelb tomentiert. Alle Tarsen tiefschwarz. Haftläppchen ockergelb, Klauen gelb, Spitze schwarz. Schwinger hellbraun. Flügel bräunlich tingiert mit dunklerer Vorderrandstrieme, die bis r_3 reicht, dem unbewaffnetem Auge besser erkennbar als dem bewaffneten.

Weib gleicht in allen Stücken dem Mann. f mit etwas gelblichem Schimmer. Theka, sechstes und siebentes Segment gelbbraun mit mattem, gelbem Reif. Seiten der andern Segmente breiter gelbbraun gefärbt als beim Mann. Scheitelblase und Stirn beiderseits längs den Augen schwärzlich eingefasst. Unterseite der Theka tiefschwarz.

Ein Weib von Surigao mit auffallend kleinen Sammetflecken an der Stirn, die fast rotbraun erscheinen. Ein ganz unausgefärbtes Weib ist nur an der Schillerverteilung zu erkennen, da der ganze Körper gelbbraun ist ohne jede Spur von Schwarzfärbung. Nur die Tarsen sind schwarz.

CONOPS OLIVACEUS sp. nov., Mann und Weib.

Drei Männer von Surigao, Mindanao, und Samar; ein Weib von Surigao.

Mann, Länge 8.9 bis 9 mm; Fühler 3 bis 3.1 mm; Flügellänge 7 mm; Flügelbreite 2 bis 2.1.

Weib, Länge 11 mm; Fühler 4.1 mm; Flügellänge 9.7 mm; Flügelbreite 3.4 mm.

Mann, Untergesicht braungelb mit goldgelbem Schiller bis zum Sammetfleck. Gesichtsgrube weissgelb glänzend mit schwarzem Mittelfleck. Stirn und Scheitel schwarzbraun, glänzend, mit concentrischen Ringen die am Augenrand zum Teil goldgelb bestäubt sind. Augenrand sonst schmal linienfein goldgelb eingefasst. Scheitelblase etwas heller braun als der Scheitel, querherüber gleich dem schwarzen Hinterkopf breit goldgelb tomentiert. Rüssel 2 mal kopflang; Basalhälfte dick, schwarz, glänzend, der Rest rostbraun mit schwarzen Lippen. Erstes Fühlerglied hellrotgelb mit weissem Reif, ca. 5 mal so lang als breit, sehr lang und schmal erscheinend; zweites kaum 2 mal so lang als das erste, dunkelbraun, durch Behaarung schwarz erscheinend, weisslich bereift; drittes breit kegelförmig, düster rotbraun, mit weissem Reif, trotzdem schwarzgrau erscheinend; so lang wie das erste. Endgriffel deutlich 3-gliedrig, dunkel erscheinend, in einer kurzen, starken Borste endend. Thorax schwarz, von vorn gesehen, mit gelbgrauem Reif übergossen. Schulterbeulen breit gelblich bereift. Schildchen, Hinterrücken, und Seitenplatten schwarz, mit glanzlosem, gelbem Reif. Brustseiten schwarz mit unscharfer, gelber, ziemlich glanzloser Strieme. Schwinger gelb bis dunkel gelbbraun. p und Hüften gelbbraun. Hüften glänzend gelb tomentiert. f braun, weiss bereift. Schenkelringe rotgelb, hell. t hell gelbbraun, an der Basis fast weisslich, dicht gelblich tomentiert. Tarsen schwarz. Haftläppchen gelb, Klauen gelb, Spitze schwarz. Flügel graubräunlich tingiert; die Vorderrandbinde lässt die erste Basalzelle hell, füllt die erste Hinterrandzelle ganz aus. Sie ist fast schwarzbraun. Hinterleib schwarz, ziemlich glanzlos. Zweiter Ring gelbbraun mit schwärzlicher Mitte. Dritter an den Seiten gelbbraun. Zweiter und dritter etwas glänzend. Keine hellen Binden oder Hinterränder. Toment der letzten Ringe glanzlos gelb tomentiert. Durch den gelblichen Reif sieht das ganze Tier olive aus.

Ein Mann mit ausgedehnterer Rotgelbfärbung, die auch am dritten Ring am Hinterleib fast bis zur Mitte hinaufsteigt. Die Type ist am zweiten and dritten gelbbraun mit unscharf begrenztem, dunklem Mittelfleck. f unten an der Spitze mit gelbbraunem Längsfleck.

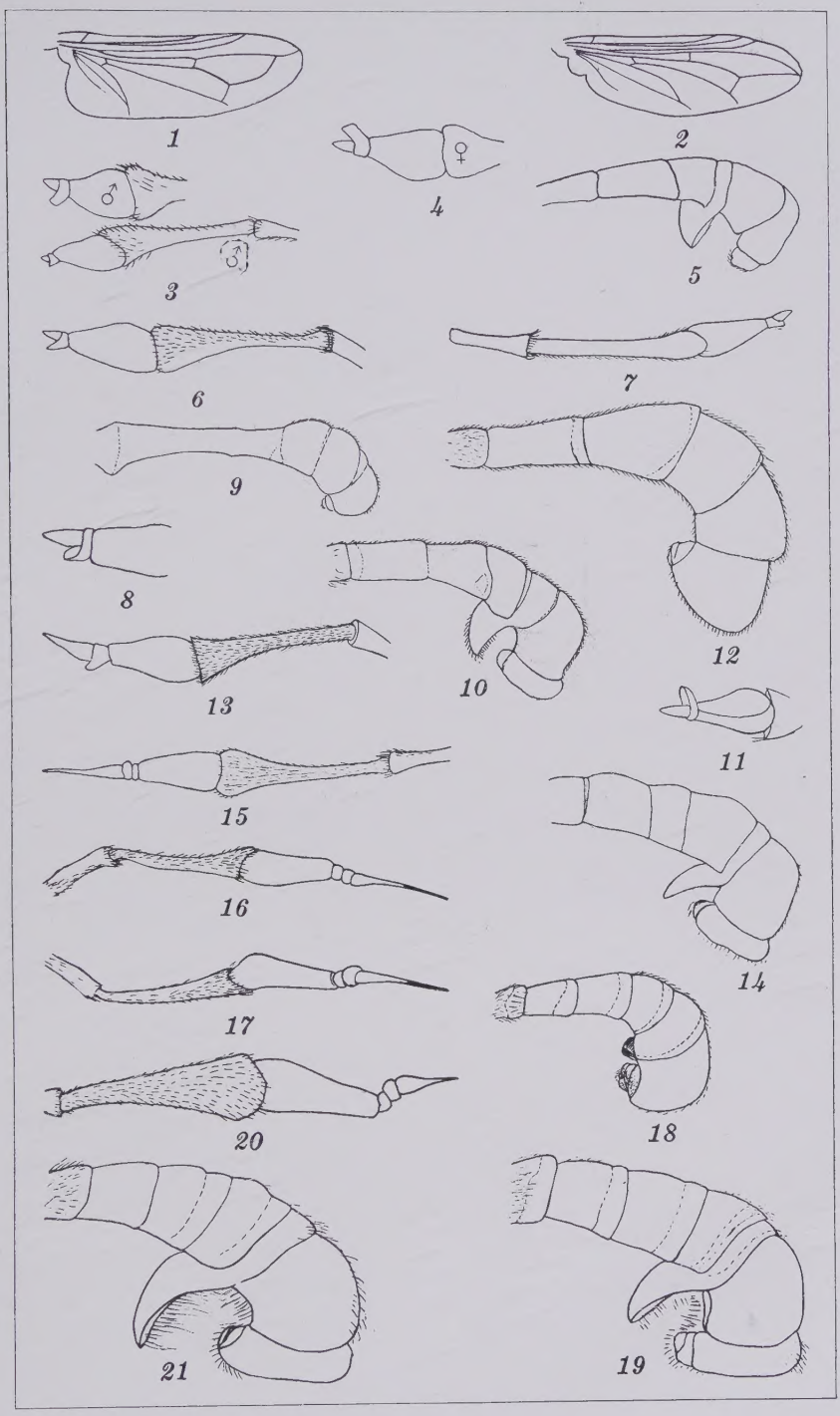
Weib gleicht dem Mann. Stirn bis fast zur Mitte hinauf hell gelbbraun. Untergesichtsgruben mit kleinem, schwärz-

lichem Fleck. Drittes Fühlerglied länger als das erste, schlanker als beim Mann. Hinterkopf heller braun. Brustseiten düster rotbraun. Hinterleib wie bei dem hellsten Mann (Type), düster gelbbraun mit verdunkelter Mitte des dritten und vierten Segments. Fünftes bis siebentes noch etwas dunkler gelbbraun, an den Seiten heller werdend. Analsegment und die gelbbraune Theka stark glänzend. Theka gross, weiter vorstehend als das Analsegment, unterseits schwarz. Hinterleib durch sehr zartes, zerstreutes, gelbes Toment ebenso olive im Ton wie beim Mann. Grundton der Flügel mehr gelbbraun, daher im ganzen heller erscheinend. Schwinger dunkelgelbbraun mit hellem Stiel.

TAFELERKLÄRUNG

Tafel 1

Fig. 1. *Physocephala* Schiner. Flügel.
2. *Conops* Linnæus. Flügel.
3. *Physocephala limbipennis* de Meijere. Fühler und Fühlerende des Mannes.
4. *Physocephala limbipennis* de Meijere. Fühlerende des Weibes.
5. *Physocephala limbipennis* de Meijere, Weib. Abdomen.
6. *Physocephala bipartita* Doleschall, Mann. Fühler.
7. *Physocephala philippinensis* sp. nov., Mann. Fühler.
8. *Physocephala philippinensis* sp. nov., Mann. Fühlerendglied mit Griffel.
9. *Physocephala philippinensis* sp. nov., Mann. Abdomen.
10. *Physocephala philippinensis* sp. nov., Weib. Abdomen.
11. *Physocephala philippinensis* sp. nov., Weib. Fühlerendglied mit Griffel.
12. *Conops philippinensis* sp. nov., Mann. Abdomen.
13. *Conops philippinensis* sp. nov., Mann. Fühler von oben.
14. *Conops nubeculosus* Bigelow var. *ornatus* Bigelow, Weib. Abdomen.
15. *Conops nubeculosus* Bigelow var. *ornatus* Bigelow, Weib. Fühler.
16. *Conops bakeri* sp. nov., Mann. Fühler.
17. *Conops bakeri* sp. nov., Weib. Fühler.
18. *Conops bakeri* sp. nov., Mann. Abdomen.
19. *Conops bakeri* sp. nov., Weib. Abdomen.
20. *Conops olivaceus* sp. nov., Mann. Fühler.
21. *Conops olivaceus* sp. nov., Weib., Abdomen.



TAFEL. 1.